



1 Decay Scheme

Actinium 228 is the naturally occurring decay daughter of thorium 232 and radium 228. The existence of an alpha branch to francium 224 is unconfirmed.

L'actinium 228 est un radionucléide naturel descendant du thorium 232 et du radium 228. Il se désintègre par transition bêta moins vers le thorium 228. L'existence d'un branchement par transition alpha n'a pas été démontré.

2 Nuclear Data

| | | | | |
|-------------------------------|---|--------|------|-----|
| $T_{1/2}({}^{228}\text{Ac})$ | : | 6,15 | (3) | h |
| $T_{1/2}({}^{228}\text{Th})$ | : | 1,9127 | (6) | a |
| $Q^\alpha({}^{228}\text{Ac})$ | : | 4814 | (50) | keV |
| $Q^-({}^{228}\text{Ac})$ | : | 2123,8 | (27) | keV |

2.1 β^- Transitions

| | Energy keV | Probability × 100 | Nature | lg <i>ft</i> |
|------------------|---------------|----------------------|--------------------------|--------------|
| $\beta_{0,60}^-$ | 0,7 (27) | 0,0047 (11) | Allowed | 3,3 |
| $\beta_{0,59}^-$ | 86,8 (27) | 0,0069 (11) | Allowed | 7,38 |
| $\beta_{0,58}^-$ | 94,0 (27) | 0,026 (4) | Allowed | 6,91 |
| $\beta_{0,57}^-$ | 101,0 (27) | 0,061 (6) | Allowed or 1st Forbidden | 6,64 |
| $\beta_{0,56}^-$ | 110,2 (27) | 0,0032 (10) | Allowed | 8,03 |
| $\beta_{0,55}^-$ | 113,7 (27) | 0,238 (15) | Allowed | 6,2 |
| $\beta_{0,54}^-$ | 136,3 (27) | 0,07 (4) | Allowed | 7 |
| $\beta_{0,53}^-$ | 158,8 (27) | 0,0132 (14) | Allowed | 7,91 |
| $\beta_{0,52}^-$ | 165,1 (27) | 0,0038 (8) | Allowed | 8,5 |
| $\beta_{0,51}^-$ | 178,9 (27) | 0,307 (22) | Allowed | 6,7 |
| $\beta_{0,50}^-$ | 186,6 (27) | 0,053 (6) | Allowed | 7,52 |
| $\beta_{0,49}^-$ | 195,2 (27) | 0,061 (8) | Allowed | 7,52 |
| $\beta_{0,48}^-$ | 217,2 (27) | 0,025 (5) | Allowed | 8,05 |

| | Energy keV | Probability × 100 | Nature | lg <i>ft</i> |
|------------------|---------------|----------------------|----------------------------|--------------|
| $\beta_{0,47}^-$ | 223,9 (27) | 0,069 (8) | Allowed | 7,65 |
| $\beta_{0,46}^-$ | 230,8 (27) | 0,109 (8) | Allowed | 7,5 |
| $\beta_{0,45}^-$ | 326,2 (27) | 0,051 (8) | Allowed | 8,3 |
| $\beta_{0,44}^-$ | 327,9 (27) | 0,035 (6) | Allowed | 8,48 |
| $\beta_{0,43}^-$ | 363,6 (27) | 0,139 (12) | Allowed | 8,02 |
| $\beta_{0,42}^-$ | 365,6 (27) | 0,060 (8) | Allowed | 8,39 |
| $\beta_{0,41}^-$ | 379,9 (27) | 0,378 (16) | Allowed | 7,65 |
| $\beta_{0,40}^-$ | 388,4 (27) | 0,149 (11) | Allowed | 8,08 |
| $\beta_{0,39}^-$ | 399,5 (27) | 1,93 (8) | Allowed | 7,01 |
| $\beta_{0,38}^-$ | 435,4 (27) | 2,50 (16) | Allowed | 7,02 |
| $\beta_{0,37}^-$ | 440,0 (27) | 0,20 (3) | 1st Forbidden | 8,13 |
| $\beta_{0,36}^-$ | 441,0 (27) | 1,21 (4) | Allowed | 7,35 |
| $\beta_{0,35}^-$ | 477,8 (27) | 4,12 (20) | Allowed | 6,94 |
| $\beta_{0,34}^-$ | 480,7 (27) | 0,82 (3) | 1st Forbidden | 7,64 |
| $\beta_{0,33}^-$ | 485,5 (27) | 1,23 (6) | Allowed | 7,48 |
| $\beta_{0,32}^-$ | 506,0 (27) | 0,071 (10) | Allowed | 8,78 |
| $\beta_{0,31}^-$ | 535,5 (27) | 8,8 (23) | 1st Forbidden | 6,77 |
| $\beta_{0,30}^-$ | 584,6 (27) | 0,030 (6) | Allowed | 9,36 |
| $\beta_{0,27}^-$ | 691,8 (27) | 1,6 (5) | Allowed | 7,88 |
| $\beta_{0,26}^-$ | 707,7 (27) | 0,060 (8) | Allowed or First Forbidden | 9,34 |
| $\beta_{0,25}^-$ | 779,7 (27) | 0,208 (18) | 1st Forbidden | 8,94 |
| $\beta_{0,24}^-$ | 826,4 (27) | 1,46 (11) | 1st Forbidden Unique | 8,18 |
| $\beta_{0,23}^-$ | 897,2 (27) | 0,67 (8) | 1st Forbidden | 8,65 |
| $\beta_{0,22}^-$ | 948,4 (27) | 0,166 (19) | Allowed | 9,34 |
| $\beta_{0,20}^-$ | 955,4 (27) | 3,39 (13) | 1st Forbidden | 8,04 |
| $\beta_{0,19}^-$ | 970,3 (27) | 6 (3) | Allowed | 7,8 |
| $\beta_{0,18}^-$ | 1000,8 (27) | 6,67 (18) | 1st Forbidden | 7,81 |
| $\beta_{0,16}^-$ | 1063,9 (27) | 0,099 (11) | 1st Forbidden | 9,74 |
| $\beta_{0,15}^-$ | 1101,3 (27) | 3,0 (4) | Allowed | 8,31 |
| $\beta_{0,14}^-$ | 1107,4 (27) | 0,39 (6) | Allowed or 1st Forbidden | 9,2 |
| $\beta_{0,13}^-$ | 1144,3 (27) | 0,238 (20) | Allowed | 9,47 |
| $\beta_{0,12}^-$ | 1154,8 (27) | 31 (4) | Allowed | 7,37 |
| $\beta_{0,11}^-$ | 1155,4 (27) | 0,18 (3) | 1st Forbidden | 9,6 |
| $\beta_{0,10}^-$ | 1179,6 (27) | 0,087 (16) | Allowed or 1st Forbidden | 9,95 |
| $\beta_{0,8}^-$ | 1249,3 (27) | 0,17 (10) | Allowed | 9,7 |
| $\beta_{0,5}^-$ | 1727,7 (27) | 12,4 (5) | 1st Forbidden | 8,4 |
| $\beta_{0,4}^-$ | 1745,6 (27) | 0,147 (21) | Unique 2nd Forbidden | 12,29 |
| $\beta_{0,3}^-$ | 1795,8 (27) | 0,72 (23) | Unique 1st Forbidden | 10,65 |
| $\beta_{0,2}^-$ | 1937,0 (27) | 0,6 (5) | Allowed | 10 |
| $\beta_{0,1}^-$ | 2066,0 (27) | 6 (4) | Allowed | 9 |

2.2 Gamma Transitions and Internal Conversion Coefficients

| | Energy keV | $P_{\gamma+ce}$ $\times 100$ | Multipolarity | α_K | α_L | α_M | α_T |
|-----------------------------|---------------|---------------------------------|---------------|--------------|--------------|---------------|--------------|
| $\gamma_{28,27}(\text{Th})$ | 18,415 (12) | 0,142 (30) | E1 | | 3,82 (6) | 2,00 (3) | 6,46 (10) |
| $\gamma_{38,35}(\text{Th})$ | 42,440 (16) | 0,43 (14) | M1 | | 35,0 (5) | 8,43 (13) | 46,3 (7) |
| $\gamma_{31,29}(\text{Th})$ | 56,861 (15) | 8 (8) | E1+[M2] | | 260 (160) | 70 (50) | 360 (220) |
| $\gamma_{1,0}(\text{Th})$ | 57,759 (4) | 72,5 (28) | E2 | | 112,2 (16) | 30,7 (5) | 153,2 (22) |
| $\gamma_{20,17}(\text{Th})$ | 77,358 (9) | 0,027 (6) | E1 | | 0,1747 (25) | 0,0426 (6) | 0,232 (4) |
| $\gamma_{29,27}(\text{Th})$ | 99,495 (8) | 6,10 (21) | M1 | | 2,90 (4) | 0,699 (10) | 3,84 (6) |
| $\gamma_{18,15}(\text{Th})$ | 100,424 (8) | 0,114 (6) | E1+M2 | | 2,27 (4) | 0,615 (9) | 3,10 (5) |
| $\gamma_{35,29}(\text{Th})$ | 114,480 (13) | 0,102 (46) | M1+E2 | 5 (5) | 3,2 (13) | 0,8 (4) | 9 (4) |
| $\gamma_{2,1}(\text{Th})$ | 129,064 (6) | 11,85 (36) | E2 | 0,264 (4) | 2,54 (4) | 0,697 (10) | 3,74 (6) |
| $\gamma_{23,17}(\text{Th})$ | 135,548 (11) | 0,024 (6) | E1 | 0,185 (3) | 0,0401 (6) | 0,00971 (14) | 0,238 (4) |
| $\gamma_{31,28}(\text{Th})$ | 137,941 (17) | 0,239 (34) | M1 | 6,00 (9) | 1,146 (16) | 0,276 (4) | 7,52 (11) |
| $\gamma_{6,4}(\text{Th})$ | 141,013 (12) | 0,055 (11) | E1 | 0,1690 (24) | 0,0362 (5) | 0,00876 (13) | 0,217 (3) |
| $\gamma_{20,15}(\text{Th})$ | 145,848 (8) | 0,169 (6) | E1 | 0,1562 (22) | 0,0332 (5) | 0,00803 (12) | 0,200 (3) |
| $\gamma_{18,12}(\text{Th})$ | 153,983 (8) | 0,754 (23) | E1 | 0,1375 (20) | 0,0289 (4) | 0,00698 (10) | 0,1757 (25) |
| $\gamma_{49,43}(\text{Th})$ | 168,35 (6) | 0,0093 (46) | M1+E2 | 1,8 (16) | 0,70 (7) | 0,18 (3) | 2,7 (15) |
| $\gamma_{25,22}(\text{Th})$ | 168,69 (5) | 0,0127 (31) | M1+E2 | 1,8 (16) | 0,70 (7) | 0,18 (3) | 2,7 (15) |
| $\gamma_{19,13}(\text{Th})$ | 173,968 (17) | 0,036 (5) | M1+E2 | 1,6 (15) | 0,63 (5) | 0,162 (22) | 2,5 (14) |
| $\gamma_{19,12}(\text{Th})$ | 184,499 (11) | 5,5 (29) | E0+M1 | 80 (30) | | | 100 (40) |
| $\gamma_{4,2}(\text{Th})$ | 191,356 (11) | 0,236 (14) | E2 | 0,1710 (24) | 0,443 (7) | 0,1209 (17) | 0,776 (11) |
| $\gamma_{20,12}(\text{Th})$ | 199,407 (7) | 0,299 (23) | E1 | 0,0752 (11) | 0,01502 (21) | 0,00362 (5) | 0,0950 (14) |
| $\gamma_{24,15}(\text{Th})$ | 204,038 (9) | 0,114 (8) | M2 | 7,26 (11) | 2,51 (4) | 0,653 (10) | 10,65 (15) |
| $\gamma_{5,2}(\text{Th})$ | 209,255 (6) | 4,31 (14) | E1 | 0,0672 (10) | 0,01333 (19) | 0,00321 (5) | 0,0848 (12) |
| $\gamma_{19,9}(\text{Th})$ | 214,89 (7) | 0,047 (8) | E2 | 0,1399 (20) | 0,274 (4) | 0,0746 (11) | 0,514 (8) |
| $\gamma_{28,23}(\text{Th})$ | 223,829 (12) | 0,058 (6) | M1+E2 | 1,48 (4) | 0,286 (5) | 0,0688 (10) | 1,85 (4) |
| $\gamma_{22,10}(\text{Th})$ | 231,19 (5) | 0,026 (4) | E2 | 0,1211 (17) | 0,199 (3) | 0,0539 (8) | 0,392 (6) |
| $\gamma_{27,21}(\text{Th})$ | 257,471 (19) | 0,0286 (19) | M1 | 1,029 (15) | 0,194 (3) | 0,0466 (7) | 1,285 (18) |
| $\gamma_{27,20}(\text{Th})$ | 263,604 (8) | 0,0451 (31) | E1 | 0,0397 (6) | 0,00760 (11) | 0,00182 (3) | 0,0498 (7) |
| $\gamma_{3,1}(\text{Th})$ | 270,244 (6) | 3,72 (10) | E1 | 0,0376 (6) | 0,00716 (10) | 0,001717 (24) | 0,0470 (7) |
| $\gamma_{27,19}(\text{Th})$ | 278,512 (12) | 0,038 (6) | E2 | 0,0843 (12) | 0,0937 (14) | 0,0252 (4) | 0,212 (3) |
| $\gamma_{19,8}(\text{Th})$ | 278,994 (21) | 0,33 (9) | M1+E2 | 0,5 (4) | 0,12 (3) | 0,031 (6) | 0,6 (4) |
| $\gamma_{28,20}(\text{Th})$ | 282,019 (11) | 0,14 (6) | M1+E2 | 0,4 (4) | 0,12 (3) | 0,030 (6) | 0,6 (4) |
| $\gamma_{19,7}(\text{Th})$ | 321,644 (14) | 0,232 (14) | E2 | 0,0635 (9) | 0,0540 (8) | 0,01444 (21) | 0,1369 (20) |
| $\gamma_{42,27}(\text{Th})$ | 326,26 (12) | 0,035 (6) | E2 | 0,0618 (9) | 0,0513 (8) | 0,01372 (20) | 0,1315 (19) |
| $\gamma_{3,0}(\text{Th})$ | 328,003 (4) | 3,13 (11) | E1 | 0,0245 (4) | 0,00455 (7) | 0,001089 (16) | 0,0305 (5) |
| $\gamma_{6,2}(\text{Th})$ | 332,369 (7) | 0,38 (6) | E1 | 0,0238 (4) | 0,00441 (7) | 0,001056 (15) | 0,0297 (5) |
| $\gamma_{5,1}(\text{Th})$ | 338,319 (6) | 11,72 (41) | E1 | 0,0229 (4) | 0,00424 (6) | 0,001014 (15) | 0,0285 (4) |
| $\gamma_{27,17}(\text{Th})$ | 340,962 (10) | 0,405 (20) | E2+M1 | 0,071 (19) | 0,0451 (21) | 0,0119 (5) | 0,133 (21) |
| $\gamma_{51,31}(\text{Th})$ | 356,560 (18) | 0,032 (15) | E1+M2 | 0,6 (6) | 0,17 (17) | 0,04 (5) | 0,8 (8) |
| $\gamma_{55,33}(\text{Th})$ | 371,83 (5) | 0,0070 (17) | E2 | 0,0475 (7) | 0,0315 (5) | 0,00834 (12) | 0,0902 (13) |
| $\gamma_{29,19}(\text{Th})$ | 378,007 (12) | 0,033 (6) | M1+E2 | 0,20 (16) | 0,049 (19) | 0,012 (5) | 0,27 (18) |
| $\gamma_{57,33}(\text{Th})$ | 384,56 (10) | 0,0070 (17) | E2 | 0,0447 (7) | 0,0282 (4) | 0,00745 (11) | 0,0828 (12) |
| $\gamma_{49,30}(\text{Th})$ | 389,36 (11) | 0,0108 (17) | M1+E2 | 0,19 (15) | 0,044 (18) | 0,011 (4) | 0,25 (17) |
| $\gamma_{50,30}(\text{Th})$ | 397,95 (13) | 0,029 (3) | | | | | |
| $\gamma_{41,25}(\text{Th})$ | 399,812 (32) | 0,0316 (41) | E1 | 0,01611 (23) | 0,00291 (4) | 0,000696 (10) | 0,0200 (3) |
| $\gamma_{27,15}(\text{Th})$ | 409,452 (8) | 2,02 (6) | E2+M1 | 0,16 (13) | 0,038 (16) | 0,009 (4) | 0,21 (15) |
| $\gamma_{30,18}(\text{Th})$ | 416,26 (9) | 0,0138 (23) | E1 | 0,01485 (21) | 0,00267 (4) | 0,000638 (9) | 0,0184 (3) |
| $\gamma_{35,23}(\text{Th})$ | 419,389 (14) | 0,0224 (31) | E1 | 0,01460 (21) | 0,00263 (4) | 0,000626 (9) | 0,0181 (3) |
| $\gamma_{29,17}(\text{Th})$ | 440,457 (10) | 0,166 (13) | M1 | 0,237 (4) | 0,0442 (7) | 0,01061 (15) | 0,295 (5) |
| $\gamma_{11,6}(\text{Th})$ | 449,177 (21) | 0,053 (6) | E2 | 0,0331 (5) | 0,01653 (24) | 0,00432 (6) | 0,0554 (8) |
| $\gamma_{27,13}(\text{Th})$ | 452,480 (15) | 0,0199 (19) | E2 | 0,0326 (5) | 0,01613 (23) | 0,00422 (6) | 0,0544 (8) |
| $\gamma_{37,23}(\text{Th})$ | 457,25 (5) | 0,0186 (39) | M1+E2 | 0,12 (10) | 0,028 (13) | 0,007 (3) | 0,16 (11) |
| $\gamma_{27,12}(\text{Th})$ | 463,011 (8) | 4,45 (24) | E2 | 0,0312 (5) | 0,01495 (21) | 0,00390 (6) | 0,0514 (8) |
| $\gamma_{33,20}(\text{Th})$ | 469,909 (10) | 0,0142 (30) | E1 | 0,01157 (17) | 0,00205 (3) | 0,000489 (7) | 0,01428 (20) |
| $\gamma_{26,10}(\text{Th})$ | 471,91 (6) | 0,0357 (42) | E2 | 0,0301 (5) | 0,01407 (20) | 0,00367 (6) | 0,0491 (7) |
| $\gamma_{34,20}(\text{Th})$ | 474,750 (16) | 0,026 (5) | M1+E2 | 0,11 (9) | 0,025 (12) | 0,006 (3) | 0,14 (10) |
| $\gamma_{8,5}(\text{Th})$ | 478,395 (19) | 0,227 (19) | E1 | 0,01118 (16) | 0,00198 (3) | 0,000471 (7) | 0,01379 (20) |
| $\gamma_{48,26}(\text{Th})$ | 490,53 (12) | 0,0116 (25) | E2 | 0,0280 (4) | 0,01242 (18) | 0,00323 (5) | 0,0447 (7) |

| | Energy keV | $P_{\gamma+ce}$ $\times 100$ | Multipolarity | α_K | α_L | α_M | α_T |
|-----------------------|---------------|---------------------------------|---------------|--------------|---------------|----------------|--------------|
| $\gamma_{35,19}$ (Th) | 492,487 (16) | 0,0282 (41) | M1+E2 | 0,10 (8) | 0,022 (11) | 0,0055 (24) | 0,13 (9) |
| $\gamma_{39,23}$ (Th) | 497,718 (9) | 0,0062 (19) | M2 | 0,437 (7) | 0,1074 (15) | 0,0268 (4) | 0,581 (9) |
| $\gamma_{7,3}$ (Th) | 503,820 (11) | 0,173 (19) | E1 | 0,01009 (15) | 0,001775 (25) | 0,000422 (6) | 0,01243 (18) |
| $\gamma_{29,15}$ (Th) | 508,947 (8) | 0,568 (45) | E2+M1 | 0,0870 (13) | 0,0196 (3) | 0,00481 (7) | 0,1130 (16) |
| $\gamma_{33,18}$ (Th) | 515,333 (11) | 0,051 (6) | E1 | 0,00966 (14) | 0,001694 (24) | 0,000403 (6) | 0,01189 (17) |
| $\gamma_{34,18}$ (Th) | 520,174 (16) | 0,070 (7) | M1+E2 | 0,09 (7) | 0,019 (9) | 0,0047 (21) | 0,11 (8) |
| $\gamma_{35,18}$ (Th) | 523,003 (13) | 0,129 (10) | E1 | 0,00937 (14) | 0,001641 (23) | 0,000390 (6) | 0,01153 (17) |
| $\gamma_{16,6}$ (Th) | 540,738 (31) | 0,0297 (38) | M1+E2 | 0,08 (6) | 0,017 (9) | 0,0042 (19) | 0,10 (7) |
| $\gamma_{8,3}$ (Th) | 546,470 (18) | 0,201 (16) | E1 | 0,00861 (12) | 0,001500 (21) | 0,000357 (5) | 0,01058 (15) |
| $\gamma_{39,22}$ (Th) | 548,89 (5) | 0,0264 (47) | M1+E2 | 0,08 (6) | 0,017 (8) | 0,0041 (18) | 0,10 (7) |
| $\gamma_{35,17}$ (Th) | 554,937 (14) | 0,048 (6) | M1+E2 | | | | |
| $\gamma_{29,12}$ (Th) | 562,506 (8) | 0,97 (7) | E2+M1 | 0,07 (5) | 0,015 (8) | 0,0038 (17) | 0,09 (6) |
| $\gamma_{39,19}$ (Th) | 570,816 (12) | 0,22 (6) | M1 | 0,1182 (17) | 0,0219 (3) | 0,00525 (8) | 0,1472 (21) |
| $\gamma_{11,5}$ (Th) | 572,291 (21) | 0,170 (22) | M1+E2 | 0,07 (5) | 0,015 (7) | 0,0036 (17) | 0,09 (6) |
| $\gamma_{13,5}$ (Th) | 583,421 (15) | 0,120 (11) | E1 | 0,00759 (11) | 0,001313 (19) | 0,000312 (5) | 0,00932 (13) |
| $\gamma_{9,3}$ (Th) | 610,58 (7) | 0,024 (5) | E1 | 0,00695 (10) | 0,001198 (17) | 0,000284 (4) | 0,00853 (12) |
| $\gamma_{10,3}$ (Th) | 616,193 (14) | 0,085 (7) | E1 | 0,00683 (10) | 0,001176 (17) | 0,000279 (4) | 0,00838 (12) |
| $\gamma_{14,5}$ (Th) | 620,328 (22) | 0,084 (7) | | | | | |
| $\gamma_{35,15}$ (Th) | 623,427 (13) | 0,0128 (33) | M1+E2 | 0,06 (4) | 0,012 (6) | 0,0028 (13) | 0,07 (5) |
| $\gamma_{34,14}$ (Th) | 626,719 (26) | 0,015 (3) | | | | | |
| $\gamma_{35,14}$ (Th) | 629,548 (24) | 0,047 (5) | E2 | 0,01754 (25) | 0,00584 (9) | 0,001489 (21) | 0,0254 (4) |
| $\gamma_{11,3}$ (Th) | 640,366 (20) | 0,058 (6) | E2 | 0,01700 (24) | 0,00556 (8) | 0,001416 (20) | 0,0245 (4) |
| $\gamma_{32,12}$ (Th) | 648,81 (7) | 0,0086 (9) | | | | | |
| $\gamma_{20,6}$ (Th) | 649,183 (8) | 0,043 (11) | E2 | 0,01658 (24) | 0,00536 (8) | 0,001362 (19) | 0,0238 (4) |
| $\gamma_{13,3}$ (Th) | 651,496 (15) | 0,094 (10) | E1 | 0,00615 (9) | 0,001053 (15) | 0,000250 (4) | 0,00754 (11) |
| $\gamma_{36,15}$ (Th) | 660,283 (31) | 0,00572 (38) | M1+E2 | 0,05 (4) | 0,010 (5) | 0,0024 (12) | 0,06 (4) |
| $\gamma_{16,5}$ (Th) | 663,852 (30) | 0,029 (6) | M1+E2 | 0,05 (4) | 0,010 (5) | 0,0024 (12) | 0,06 (4) |
| $\gamma_{46,23}$ (Th) | 666,431 (18) | 0,0068 (7) | E1 | 0,00590 (9) | 0,001007 (14) | 0,000239 (4) | 0,00722 (11) |
| $\gamma_{35,13}$ (Th) | 666,455 (18) | 0,061 (7) | M1+E2 | 0,05 (4) | 0,010 (5) | 0,0024 (11) | 0,06 (4) |
| $\gamma_{38,14}$ (Th) | 671,988 (24) | 0,027 (8) | | | | | |
| $\gamma_{34,12}$ (Th) | 674,157 (16) | 0,105 (10) | M1+E2 | 0,05 (3) | 0,009 (5) | 0,0023 (11) | 0,06 (4) |
| $\gamma_{35,12}$ (Th) | 676,986 (13) | 0,065 (6) | M1+E2 | 0,05 (3) | 0,009 (5) | 0,0023 (11) | 0,06 (4) |
| $\gamma_{14,3}$ (Th) | 688,403 (21) | 0,070 (7) | | | | | |
| $\gamma_{34,10}$ (Th) | 698,929 (20) | 0,038 (6) | E2 | 0,01448 (21) | 0,00436 (7) | 0,001103 (16) | 0,0203 (3) |
| $\gamma_{39,15}$ (Th) | 701,756 (8) | 0,181 (15) | M1 | 0,0684 (10) | 0,01261 (18) | 0,00302 (5) | 0,0850 (12) |
| $\gamma_{23,6}$ (Th) | 707,373 (9) | 0,162 (18) | E2 | 0,01417 (20) | 0,00422 (6) | 0,001067 (15) | 0,0198 (3) |
| $\gamma_{51,23}$ (Th) | 718,330 (13) | 0,0191 (40) | E1 | 0,00513 (8) | 0,000870 (13) | 0,000206 (3) | 0,00628 (9) |
| $\gamma_{18,5}$ (Th) | 726,873 (8) | 0,68 (8) | E2 | 0,01349 (19) | 0,00393 (6) | 0,000990 (14) | 0,0187 (3) |
| $\gamma_{43,15}$ (Th) | 737,691 (25) | 0,039 (5) | M1+E2 | 0,037 (24) | 0,007 (4) | 0,0018 (9) | 0,05 (3) |
| $\gamma_{39,12}$ (Th) | 755,315 (8) | 1,102 (43) | M1 | 0,0563 (8) | 0,01036 (15) | 0,00248 (4) | 0,070 (1) |
| $\gamma_{20,5}$ (Th) | 772,297 (7) | 1,52 (6) | M1+E2 | 0,0186 (11) | 0,00437 (18) | 0,00108 (5) | 0,0244 (14) |
| $\gamma_{7,1}$ (Th) | 774,064 (11) | 0,0630 (41) | E2 | 0,01204 (17) | 0,00333 (5) | 0,000835 (12) | 0,01649 (23) |
| $\gamma_{51,20}$ (Th) | 776,520 (12) | 0,020 (6) | | | | | |
| $\gamma_{12,2}$ (Th) | 782,145 (6) | 0,508 (41) | E2 | 0,01182 (17) | 0,00324 (5) | 0,000812 (12) | 0,01615 (23) |
| $\gamma_{43,12}$ (Th) | 791,250 (25) | 0,0104 (31) | M1+E2 | 0,031 (19) | 0,006 (3) | 0,0015 (7) | 0,039 (23) |
| $\gamma_{51,19}$ (Th) | 791,428 (15) | 0,0149 (42) | M1 | 0,0498 (7) | 0,00915 (13) | 0,00219 (3) | 0,0618 (9) |
| $\gamma_{13,2}$ (Th) | 792,676 (15) | 0,082 (5) | E2 | 0,01154 (17) | 0,00313 (5) | 0,000784 (11) | 0,01572 (22) |
| $\gamma_{18,3}$ (Th) | 794,948 (7) | 4,31 (14) | E2+M1 | 0,0133 (12) | 0,00340 (19) | 0,00085 (5) | 0,0179 (14) |
| $\gamma_{38,8}$ (Th) | 813,921 (21) | 0,0073 (17) | M1+E2 | 0,029 (18) | 0,006 (3) | 0,0014 (7) | 0,036 (22) |
| $\gamma_{8,1}$ (Th) | 816,714 (18) | 0,0321 (42) | M1+E2 | 0,028 (18) | 0,006 (3) | 0,0014 (7) | 0,036 (21) |
| $\gamma_{25,6}$ (Th) | 824,886 (13) | 0,054 (6) | E2 | 0,01074 (15) | 0,00283 (4) | 0,000706 (10) | 0,01452 (21) |
| $\gamma_{23,5}$ (Th) | 830,487 (9) | 0,61 (6) | E2+M1 | 0,01117 (22) | 0,00287 (5) | 0,000715 (12) | 0,0150 (3) |
| $\gamma_{15,2}$ (Th) | 835,704 (7) | 1,70 (7) | E2 | 0,01050 (15) | 0,00274 (4) | 0,000683 (10) | 0,01415 (20) |
| $\gamma_{20,3}$ (Th) | 840,372 (6) | 0,984 (41) | E2 | 0,01039 (15) | 0,00270 (4) | 0,000673 (10) | 0,0140 (2) |
| $\gamma_{51,17}$ (Th) | 853,878 (14) | 0,0128 (21) | M1+E2 | 0,025 (16) | 0,0050 (25) | 0,0012 (6) | 0,032 (19) |
| $\gamma_{46,15}$ (Th) | 870,469 (18) | 0,046 (5) | M1 | 0,0387 (6) | 0,0071 (1) | 0,001699 (24) | 0,0481 (7) |
| $\gamma_{16,2}$ (Th) | 873,107 (30) | 0,032 (7) | E1 | 0,00361 (5) | 0,000601 (9) | 0,0001422 (20) | 0,00440 (7) |
| $\gamma_{8,0}$ (Th) | 874,473 (18) | 0,051 (11) | E2 | 0,00968 (14) | 0,00245 (4) | 0,000608 (9) | 0,01294 (19) |
| $\gamma_{47,15}$ (Th) | 877,423 (40) | 0,0144 (31) | M1+E2 | 0,024 (15) | 0,0047 (23) | 0,0011 (6) | 0,030 (18) |

| | Energy keV | $P_{\gamma+ce}$ $\times 100$ | Multipolarity | α_K | α_L | α_M | α_T |
|-----------------------|---------------|---------------------------------|---------------|--------------|---------------|----------------|--------------|
| $\gamma_{9,1}$ (Th) | 880,82 (7) | 0,0066 (19) | E2 | 0,00956 (14) | 0,00240 (4) | 0,000597 (9) | 0,01276 (18) |
| $\gamma_{55,18}$ (Th) | 887,16 (5) | 0,029 (3) | M1+E2 | 0,023 (14) | 0,0046 (22) | 0,0011 (6) | 0,029 (17) |
| $\gamma_{24,5}$ (Th) | 901,345 (11) | 0,0172 (40) | E2 | 0,00917 (13) | 0,00227 (4) | 0,000564 (8) | 0,01220 (17) |
| $\gamma_{17,2}$ (Th) | 904,194 (9) | 0,78 (4) | E2 | 0,00912 (13) | 0,00225 (4) | 0,000559 (8) | 0,01212 (17) |
| $\gamma_{12,1}$ (Th) | 911,209 (6) | 26,5 (8) | E2 | 0,00900 (13) | 0,00221 (3) | 0,000549 (8) | 0,01194 (17) |
| $\gamma_{55,17}$ (Th) | 919,09 (5) | 0,028 (3) | | | | | |
| $\gamma_{13,1}$ (Th) | 921,740 (15) | 0,0158 (24) | M1+E2 | 0,021 (13) | 0,0041 (20) | 0,0010 (5) | 0,027 (15) |
| $\gamma_{47,12}$ (Th) | 930,982 (40) | 0,004 (1) | | | | | |
| $\gamma_{28,6}$ (Th) | 931,202 (12) | 0,0026 (24) | M1+E2 | 0,021 (12) | 0,004 (2) | 0,0010 (5) | 0,026 (15) |
| $\gamma_{58,17}$ (Th) | 938,82 (16) | 0,009 (3) | | | | | |
| $\gamma_{10,0}$ (Th) | 944,196 (13) | 0,102 (10) | E1+M2 | 0,020 (12) | 0,0039 (19) | 0,0009 (5) | 0,025 (14) |
| $\gamma_{25,5}$ (Th) | 948,000 (12) | 0,111 (10) | M1+E2 | 0,020 (12) | 0,0038 (19) | 0,0009 (5) | 0,025 (14) |
| $\gamma_{14,1}$ (Th) | 958,647 (21) | 0,29 (5) | | | | | |
| $\gamma_{15,1}$ (Th) | 964,768 (7) | 4,99 (17) | E2+M1 | 0,00853 (19) | 0,00199 (4) | 0,000492 (9) | 0,01119 (23) |
| $\gamma_{12,0}$ (Th) | 968,968 (5) | 16,1 (5) | E2 | 0,00806 (12) | 0,00191 (3) | 0,000472 (7) | 0,01061 (15) |
| $\gamma_{51,12}$ (Th) | 975,927 (12) | 0,052 (6) | M1 | 0,0287 (4) | 0,00524 (8) | 0,001254 (18) | 0,0356 (5) |
| $\gamma_{13,0}$ (Th) | 979,499 (14) | 0,0283 (30) | E2 | 0,00791 (11) | 0,00186 (3) | 0,000459 (7) | 0,01039 (15) |
| $\gamma_{21,2}$ (Th) | 987,685 (18) | 0,14 (6) | M1+E2 | 0,018 (10) | 0,0034 (17) | 0,0008 (4) | 0,022 (13) |
| $\gamma_{22,2}$ (Th) | 988,57 (5) | 0,081 (14) | E2 | 0,00778 (11) | 0,00182 (3) | 0,000449 (7) | 0,01021 (15) |
| $\gamma_{51,10}$ (Th) | 1000,699 (17) | 0,0054 (3) | | | | | |
| $\gamma_{58,14}$ (Th) | 1013,43 (16) | 0,0097 (16) | | | | | |
| $\gamma_{14,0}$ (Th) | 1016,406 (21) | 0,0194 (31) | M1+E2 | 0,017 (10) | 0,0032 (15) | 0,0008 (4) | 0,021 (12) |
| $\gamma_{54,12}$ (Th) | 1018,49 (10) | 0,032 (32) | E2+M3 | 0,05 (5) | 0,014 (12) | 0,003 (3) | 0,07 (7) |
| $\gamma_{26,5}$ (Th) | 1020,03 (6) | 0,022 (5) | | | | | |
| $\gamma_{17,1}$ (Th) | 1033,258 (9) | 0,204 (12) | E2 | 0,0072 (1) | 0,001643 (23) | 0,000404 (6) | 0,00938 (14) |
| $\gamma_{23,2}$ (Th) | 1039,742 (8) | 0,056 (18) | | | | | |
| $\gamma_{55,12}$ (Th) | 1041,14 (5) | 0,047 (10) | E2+M3 | 0,05 (5) | 0,013 (12) | 0,003 (3) | 0,07 (6) |
| $\gamma_{57,12}$ (Th) | 1053,87 (10) | 0,0143 (41) | M1+E2 | 0,015 (9) | 0,0029 (14) | 0,0007 (4) | 0,019 (10) |
| $\gamma_{28,5}$ (Th) | 1054,316 (11) | 0,019 (6) | M1+E2 | 0,015 (9) | 0,0029 (14) | 0,0007 (4) | 0,019 (10) |
| $\gamma_{50,8}$ (Th) | 1062,69 (9) | 0,011 (4) | | | | | |
| $\gamma_{18,1}$ (Th) | 1065,192 (7) | 0,135 (8) | | | | | |
| $\gamma_{48,7}$ (Th) | 1074,82 (10) | 0,011 (4) | | | | | |
| $\gamma_{26,3}$ (Th) | 1088,11 (6) | 0,0062 (14) | | | | | |
| $\gamma_{19,1}$ (Th) | 1095,708 (11) | 0,126 (10) | M1+E2 | 0,014 (8) | 0,0026 (13) | 0,0006 (3) | 0,017 (9) |
| $\gamma_{27,3}$ (Th) | 1103,976 (7) | 0,0102 (11) | E3 | 0,01377 (20) | 0,00429 (6) | 0,001090 (16) | 0,0195 (3) |
| $\gamma_{24,2}$ (Th) | 1110,600 (11) | 0,0273 (21) | E1 | 0,00237 (4) | 0,000388 (6) | 0,0000915 (13) | 0,00288 (4) |
| $\gamma_{20,1}$ (Th) | 1110,616 (6) | 0,285 (22) | E1 | 0,00237 (4) | 0,000388 (6) | 0,0000915 (13) | 0,00288 (4) |
| $\gamma_{22,1}$ (Th) | 1117,63 (5) | 0,061 (7) | | | | | |
| $\gamma_{29,5}$ (Th) | 1135,396 (8) | 0,0102 (17) | | | | | |
| $\gamma_{30,5}$ (Th) | 1143,13 (9) | 0,0108 (22) | | | | | |
| $\gamma_{57,8}$ (Th) | 1148,37 (10) | 0,0062 (14) | M1+E2 | 0,012 (7) | 0,0023 (11) | 0,00057 (25) | 0,015 (8) |
| $\gamma_{19,0}$ (Th) | 1153,467 (10) | 0,148 (13) | E1+M2 | 0,022 (20) | 0,004 (5) | 0,0011 (10) | 0,03 (3) |
| $\gamma_{25,2}$ (Th) | 1157,255 (12) | 0,0073 (14) | E1+M2 | 0,022 (20) | 0,004 (4) | 0,0011 (10) | 0,03 (3) |
| $\gamma_{37,6}$ (Th) | 1164,63 (5) | 0,067 (7) | M1+E2 | 0,012 (6) | 0,0023 (11) | 0,00055 (24) | 0,015 (8) |
| $\gamma_{22,0}$ (Th) | 1175,39 (5) | 0,0257 (42) | E1+M2 | 0,021 (19) | 0,004 (4) | 0,001 (1) | 0,027 (24) |
| $\gamma_{57,7}$ (Th) | 1191,02 (10) | 0,0065 (17) | M1+E2 | 0,011 (6) | 0,0021 (10) | 0,00052 (23) | 0,014 (7) |
| $\gamma_{40,6}$ (Th) | 1216,258 (26) | 0,022 (4) | | | | | |
| $\gamma_{26,2}$ (Th) | 1229,29 (6) | 0,0078 (25) | | | | | |
| $\gamma_{27,2}$ (Th) | 1245,156 (7) | 0,110 (8) | M1+E2 | 0,010 (5) | 0,0019 (9) | 0,00046 (20) | 0,013 (6) |
| $\gamma_{34,5}$ (Th) | 1247,047 (16) | 0,524 (24) | M1 | 0,01505 (21) | 0,00274 (4) | 0,000654 (10) | 0,0187 (3) |
| $\gamma_{35,5}$ (Th) | 1249,876 (13) | 0,065 (6) | | | | | |
| $\gamma_{44,6}$ (Th) | 1276,71 (10) | 0,015 (3) | | | | | |
| $\gamma_{25,1}$ (Th) | 1286,319 (12) | 0,052 (11) | E1+M2 | | | | |
| $\gamma_{37,5}$ (Th) | 1287,74 (5) | 0,109 (25) | M1+E2 | 0,009 (5) | 0,0018 (8) | 0,00042 (18) | 0,012 (6) |
| $\gamma_{33,3}$ (Th) | 1310,281 (10) | 0,020 (7) | E1+M2 | 0,016 (15) | 0,003 (3) | 0,0008 (7) | 0,020 (18) |
| $\gamma_{34,3}$ (Th) | 1315,122 (16) | 0,0152 (30) | M1+E2 | 0,009 (5) | 0,0017 (7) | 0,00040 (17) | 0,011 (6) |
| $\gamma_{29,2}$ (Th) | 1344,651 (7) | 0,0094 (20) | M1+E2 | 0,008 (4) | 0,0016 (7) | 0,00038 (16) | 0,011 (5) |
| $\gamma_{41,5}$ (Th) | 1347,812 (30) | 0,0163 (41) | E1+M2 | 0,015 (14) | 0,003 (3) | 0,0007 (7) | 0,019 (17) |
| $\gamma_{40,4}$ (Th) | 1357,271 (27) | 0,021 (5) | | | | | |

| | Energy keV | $P_{\gamma+ce}$ $\times 100$ | Multipolarity | α_K | α_L | α_M | α_T |
|----------------------|---------------|---------------------------------|---------------|--------------|---------------|----------------|--------------|
| $\gamma_{41,4}$ (Th) | 1365,711 (32) | 0,0144 (31) | E2+M3 | 0,025 (21) | 0,006 (5) | 0,0014 (12) | 0,03 (3) |
| $\gamma_{27,1}$ (Th) | 1374,220 (7) | 0,0196 (14) | E2+M3 | 0,024 (20) | 0,005 (5) | 0,0014 (12) | 0,03 (3) |
| $\gamma_{45,5}$ (Th) | 1401,57 (8) | 0,0132 (31) | E1+M2 | 0,013 (12) | 0,0026 (24) | 0,0006 (6) | 0,017 (15) |
| $\gamma_{41,3}$ (Th) | 1415,887 (30) | 0,022 (5) | E3 | 0,00849 (12) | 0,00218 (3) | 0,000543 (8) | 0,01141 (16) |
| $\gamma_{32,2}$ (Th) | 1430,96 (7) | 0,037 (8) | | | | | |
| $\gamma_{28,0}$ (Th) | 1450,394 (10) | 0,0111 (22) | M1+E2 | 0,007 (3) | 0,0013 (6) | 0,00031 (13) | 0,009 (4) |
| $\gamma_{35,2}$ (Th) | 1459,131 (13) | 0,89 (6) | E2 | 0,00391 (6) | 0,000771 (11) | 0,000187 (3) | 0,00498 (7) |
| $\gamma_{45,3}$ (Th) | 1469,65 (8) | 0,021 (5) | E1+M2 | 0,012 (11) | 0,0023 (21) | 0,0006 (5) | 0,015 (14) |
| $\gamma_{36,2}$ (Th) | 1495,987 (30) | 0,924 (30) | E2 | 0,00374 (6) | 0,000732 (11) | 0,0001769 (25) | 0,00477 (7) |
| $\gamma_{38,2}$ (Th) | 1501,571 (12) | 0,513 (17) | | | | | |
| $\gamma_{39,2}$ (Th) | 1537,460 (7) | 0,049 (6) | E2+M3 | 0,018 (15) | 0,004 (4) | 0,0010 (8) | 0,023 (19) |
| $\gamma_{40,2}$ (Th) | 1548,627 (25) | 0,040 (5) | | | | | |
| $\gamma_{41,2}$ (Th) | 1557,067 (30) | 0,173 (9) | E2+M1 | 0,0055 (5) | 0,00102 (8) | 0,000245 (19) | 0,0070 (6) |
| $\gamma_{32,1}$ (Th) | 1560,02 (7) | 0,021 (5) | | | | | |
| $\gamma_{42,2}$ (Th) | 1571,42 (12) | 0,0059 (17) | | | | | |
| $\gamma_{43,2}$ (Th) | 1573,395 (24) | 0,0341 (40) | E2 | 0,00342 (5) | 0,00066 0(1) | 0,0001592 (23) | 0,00438 (7) |
| $\gamma_{33,1}$ (Th) | 1580,525 (10) | 0,624 (40) | M1+E2 | 0,0057 (24) | 0,0011 (4) | 0,00025 (10) | 0,007 (3) |
| $\gamma_{35,1}$ (Th) | 1588,195 (13) | 3,06 (12) | E2 | 0,0057 (23) | 0,0010 (4) | 0,00025 (10) | 0,007 (3) |
| $\gamma_{54,4}$ (Th) | 1609,28 (10) | 0,0081 (17) | E2 | 0,00329 (5) | 0,000630 (9) | 0,0001518 (22) | 0,00422 (6) |
| $\gamma_{36,1}$ (Th) | 1625,051 (30) | 0,270 (23) | E2+M3 | 0,016 (13) | 0,003 (3) | 0,0008 (7) | 0,020 (17) |
| $\gamma_{38,1}$ (Th) | 1630,635 (12) | 1,52 (6) | M1+E2 | 0,0053 (22) | 0,0010 (4) | 0,00023 (9) | 0,007 (3) |
| $\gamma_{33,0}$ (Th) | 1638,284 (9) | 0,462 (30) | E2 | 0,00319 (5) | 0,000608 (9) | 0,0001463 (21) | 0,00410 (6) |
| $\gamma_{39,1}$ (Th) | 1666,524 (7) | 0,173 (9) | M1 | 0,00702 (10) | 0,001269 (18) | 0,000303 (5) | 0,00895 (13) |
| $\gamma_{40,1}$ (Th) | 1677,691 (25) | 0,057 (6) | | | | | |
| $\gamma_{41,1}$ (Th) | 1686,131 (30) | 0,094 (7) | E2 | 0,00303 (5) | 0,000573 (8) | 0,0001378 (20) | 0,00391 (6) |
| $\gamma_{42,1}$ (Th) | 1700,48 (12) | 0,0105 (25) | | | | | |
| $\gamma_{43,1}$ (Th) | 1702,459 (24) | 0,055 (7) | E2+M3 | 0,014 (11) | 0,0030 (25) | 0,0007 (6) | 0,018 (15) |
| $\gamma_{46,2}$ (Th) | 1706,173 (17) | 0,0089 (12) | M1+E2 | 0,0061 (10) | 0,00110 (16) | 0,00026 (4) | 0,0078 (12) |
| $\gamma_{47,2}$ (Th) | 1713,127 (40) | 0,0057 (11) | E2+M3 | 0,014 (11) | 0,0029 (24) | 0,0007 (6) | 0,018 (14) |
| $\gamma_{39,0}$ (Th) | 1724,283 (6) | 0,030 (4) | E1+M2 | | | | |
| $\gamma_{44,1}$ (Th) | 1738,14 (10) | 0,018 (4) | | | | | |
| $\gamma_{45,1}$ (Th) | 1739,89 (8) | 0,011 (4) | | | | | |
| $\gamma_{49,2}$ (Th) | 1741,75 (6) | 0,0084 (25) | M1+E2 | | | | |
| $\gamma_{50,2}$ (Th) | 1750,34 (9) | 0,0084 (9) | | | | | |
| $\gamma_{51,2}$ (Th) | 1758,072 (12) | 0,0361 (40) | E2+M1 | 0,00285 (4) | 0,000533 (8) | 0,0001281 (18) | 0,00371 (6) |
| $\gamma_{52,2}$ (Th) | 1771,90 (22) | 0,0019 (5) | E2+M3 | 0,013 (10) | 0,0027 (22) | 0,0007 (6) | 0,016 (13) |
| $\gamma_{60,3}$ (Th) | 1795,1 (3) | 0,0022 (8) | | | | | |
| $\gamma_{45,0}$ (Th) | 1797,65 (8) | 0,0022 (8) | E1+M2 | 0,007 (7) | 0,0014 (13) | 0,0003 (3) | 0,009 (8) |
| $\gamma_{54,2}$ (Th) | 1800,64 (10) | 0,0046 (8) | | | | | |
| $\gamma_{55,2}$ (Th) | 1823,29 (5) | 0,046 (5) | | | | | |
| $\gamma_{56,2}$ (Th) | 1826,78 (30) | 0,0022 (8) | | | | | |
| $\gamma_{46,1}$ (Th) | 1835,237 (17) | 0,0381 (40) | E2+M1 | 0,00291 (8) | 0,000536 (14) | 0,000128 (4) | 0,00382 (10) |
| $\gamma_{47,1}$ (Th) | 1842,191 (40) | 0,037 (6) | M1+E2 | 0,00420 (25) | 0,00076 (5) | 0,000182 (11) | 0,0055 (4) |
| $\gamma_{59,2}$ (Th) | 1850,17 (17) | 0,0046 (8) | | | | | |
| $\gamma_{49,1}$ (Th) | 1870,81 (6) | 0,0257 (24) | M1+E2 | 0,0038 (14) | 0,00070 (24) | 0,00017 (6) | 0,0051 (18) |
| $\gamma_{50,1}$ (Th) | 1879,40 (9) | 0,0013 (5) | | | | | |
| $\gamma_{51,1}$ (Th) | 1887,136 (12) | 0,094 (7) | E2+M1 | 0,0038 (13) | 0,00068 (23) | 0,00016 (6) | 0,0050 (17) |
| $\gamma_{47,0}$ (Th) | 1899,95 (4) | 0,0030 (6) | E1+M2 | 0,006 (6) | 0,0012 (11) | 0,0003 (3) | 0,008 (7) |
| $\gamma_{53,1}$ (Th) | 1907,22 (7) | 0,0124 (13) | | | | | |
| $\gamma_{54,1}$ (Th) | 1929,7 (1) | 0,0208 (14) | E2+M3 | 0,010 (8) | 0,0021 (17) | 0,0005 (5) | 0,013 (10) |
| $\gamma_{60,2}$ (Th) | 1936,28 (30) | 0,0022 (6) | | | | | |
| $\gamma_{55,1}$ (Th) | 1952,35 (5) | 0,062 (5) | E2+M3 | 0,010 (8) | 0,0020 (17) | 0,0005 (4) | 0,013 (10) |
| $\gamma_{56,1}$ (Th) | 1955,84 (30) | 0,0008 (3) | | | | | |
| $\gamma_{52,0}$ (Th) | 1958,72 (22) | 0,0016 (5) | E1+M2 | | | | |
| $\gamma_{57,1}$ (Th) | 1965,08 (10) | 0,0223 (22) | M1+E2 | 0,0034 (12) | 0,00062 (20) | 0,00015 (5) | 0,0046 (15) |
| $\gamma_{58,1}$ (Th) | 1972,08 (16) | 0,0038 (8) | | | | | |
| $\gamma_{59,1}$ (Th) | 1979,23 (17) | 0,0019 (5) | | | | | |
| $\gamma_{58,0}$ (Th) | 2029,84 (16) | 0,0019 (5) | E1+M2 | 0,005 (5) | 0,0010 (9) | 0,00024 (22) | 0,007 (6) |

3 Atomic Data

3.1 Th

| | | | |
|------------------|---|-------|------|
| ω_K | : | 0,969 | (4) |
| $\bar{\omega}_L$ | : | 0,476 | (18) |
| n_{KL} | : | 0,797 | (5) |

3.1.1 X Radiations

| | Energy keV | Relative probability |
|----------------|-------------------|-------------------------|
| X _K | | |
| K α_2 | 89,954 | 61,82 |
| K α_1 | 93,351 | 100 |
| K β_3 | 104,819 | } |
| K β_1 | 105,604 | } |
| K β_5'' | 106,239 | } |
| | | 35,58 |
| K β_2 | 108,509 | } |
| K β_4 | 108,955 | } |
| K $O_{2,3}$ | 109,442 | } |
| | | 11,99 |
| X _L | | |
| L ℓ | 11,1177 | |
| L α | 12,8085 – 12,967 | |
| L η | 14,509 | |
| L β | 14,972 – 16,4253 | |
| L γ | 18,3633 – 19,5043 | |

3.1.2 Auger Electrons

| | Energy keV | Relative probability |
|---------|-----------------|-------------------------|
| Auger K | | |
| KLL | 68,406 – 76,745 | 100 |
| KLX | 83,857 – 93,345 | 58,8 |
| KXY | 99,29 – 109,64 | 8,64 |
| Auger L | 5,8 – 20,3 | |

4 Electron Emissions

| | | Energy keV | Electrons per 100 disint. |
|-----------------------|------|-------------------|------------------------------|
| e _{AL} | (Th) | 5,8 - 20,3 | 40 (8) |
| e _{AK} | (Th) | | 27 (8) |
| | KLL | 68,406 - 76,745 | } |
| | KLX | 83,857 - 93,345 | } |
| | KXY | 99,29 - 109,64 | } |
| ec _{2,1} K | (Th) | 19,414 (6) | 0,660 (21) |
| ec _{38,35} L | (Th) | 21,97 - 26,10 | 0,32 (11) |
| ec _{31,28} K | (Th) | 28,291 (17) | 0,168 (24) |
| ec _{31,29} L | (Th) | 36,389 - 40,600 | 5,2 (35) |
| ec _{1,0} L | (Th) | 37,287 - 41,500 | 52,7 (21) |
| ec _{18,12} K | (Th) | 44,333 (8) | 0,104 (4) |
| ec _{31,29} M | (Th) | 51,679 - 53,529 | 1,4 (11) |
| ec _{1,0} M | (Th) | 52,577 - 54,427 | 14,4 (6) |
| ec _{31,29} N | (Th) | 55,530 - 56,526 | 0,40 (26) |
| ec _{1,0} N | (Th) | 56,430 - 57,424 | 3,87 (15) |
| ec _{19,12} K | (Th) | 74,849 (11) | 4,3 (22) |
| ec _{29,27} L | (Th) | 79,023 - 83,200 | 3,65 (13) |
| ec _{18,15} L | (Th) | 79,952 - 84,100 | 0,259 (14) |
| ec _{29,27} M | (Th) | 94,313 - 96,163 | 0,881 (31) |
| ec _{24,15} K | (Th) | 94,388 (9) | 0,83 (6) |
| ec _{29,27} N | (Th) | 98,16 - 99,16 | 0,234 (8) |
| ec _{5,2} K | (Th) | 99,605 (6) | 0,267 (10) |
| ec _{2,1} L | (Th) | 108,592 - 112,800 | 6,35 (20) |
| ec _{2,1} M | (Th) | 123,882 - 125,732 | 1,74 (5) |
| ec _{2,1} N | (Th) | 127,730 - 128,729 | 0,468 (15) |
| ec _{3,1} K | (Th) | 160,594 (6) | 0,1335 (43) |
| ec _{19,8} K | (Th) | 169,344 (21) | 0,10 (8) |
| ec _{24,15} L | (Th) | 183,566 - 187,700 | 0,286 (21) |
| ec _{5,1} K | (Th) | 228,669 (6) | 0,261 (10) |
| ec _{27,15} K | (Th) | 299,802 (8) | 0,32 (26) |
| ec _{27,12} K | (Th) | 353,361 (8) | 0,139 (8) |
| ec _{12,1} K | (Th) | 801,559 (6) | 0,236 (8) |
| ec _{12,0} K | (Th) | 859,318 (5) | 0,128 (5) |
| $\beta_{0,60}^-$ | max: | 0,7 (27) | 0,0047 (11) |
| $\beta_{0,60}^-$ | avg: | 0,18 (68) | |
| $\beta_{0,59}^-$ | max: | 86,8 (27) | 0,0069 (11) |
| $\beta_{0,59}^-$ | avg: | 22,4 (8) | |
| $\beta_{0,58}^-$ | max: | 94,0 (27) | 0,026 (4) |
| $\beta_{0,58}^-$ | avg: | 24,3 (7) | |
| $\beta_{0,57}^-$ | max: | 101,0 (27) | 0,061 (6) |
| $\beta_{0,57}^-$ | avg: | 26,2 (7) | |

| | | Energy keV | | Electrons per 100 disint. |
|------------------|------|---------------|------|------------------------------|
| $\beta_{0,56}^-$ | max: | 110,2 | (27) | 0,0032 (10) |
| $\beta_{0,56}^-$ | avg: | 28,7 | (7) | |
| $\beta_{0,55}^-$ | max: | 113,7 | (27) | 0,238 (15) |
| $\beta_{0,55}^-$ | avg: | 29,7 | (8) | |
| $\beta_{0,54}^-$ | max: | 136,3 | (27) | 0,07 (4) |
| $\beta_{0,54}^-$ | avg: | 35,9 | (8) | |
| $\beta_{0,53}^-$ | max: | 158,8 | (27) | 0,0132 (14) |
| $\beta_{0,53}^-$ | avg: | 42,2 | (8) | |
| $\beta_{0,52}^-$ | max: | 165,1 | (27) | 0,0038 (8) |
| $\beta_{0,52}^-$ | avg: | 43,9 | (8) | |
| $\beta_{0,51}^-$ | max: | 178,9 | (27) | 0,307 (22) |
| $\beta_{0,51}^-$ | avg: | 47,8 | (8) | |
| $\beta_{0,50}^-$ | max: | 186,6 | (27) | 0,053 (6) |
| $\beta_{0,50}^-$ | avg: | 50,0 | (8) | |
| $\beta_{0,49}^-$ | max: | 195,2 | (27) | 0,061 (8) |
| $\beta_{0,49}^-$ | avg: | 52,5 | (8) | |
| $\beta_{0,48}^-$ | max: | 217,2 | (27) | 0,025 (5) |
| $\beta_{0,48}^-$ | avg: | 58,8 | (8) | |
| $\beta_{0,47}^-$ | max: | 223,9 | (27) | 0,069 (8) |
| $\beta_{0,47}^-$ | avg: | 60,8 | (8) | |
| $\beta_{0,46}^-$ | max: | 230,8 | (27) | 0,109 (8) |
| $\beta_{0,46}^-$ | avg: | 62,8 | (8) | |
| $\beta_{0,45}^-$ | max: | 326,2 | (27) | 0,051 (8) |
| $\beta_{0,45}^-$ | avg: | 91,4 | (8) | |
| $\beta_{0,44}^-$ | max: | 327,9 | (27) | 0,035 (6) |
| $\beta_{0,44}^-$ | avg: | 91,9 | (8) | |
| $\beta_{0,43}^-$ | max: | 363,6 | (27) | 0,139 (12) |
| $\beta_{0,43}^-$ | avg: | 103,0 | (9) | |
| $\beta_{0,42}^-$ | max: | 365,6 | (27) | 0,060 (8) |
| $\beta_{0,42}^-$ | avg: | 103,6 | (9) | |
| $\beta_{0,41}^-$ | max: | 379,9 | (27) | 0,378 (16) |
| $\beta_{0,41}^-$ | avg: | 108,1 | (9) | |
| $\beta_{0,40}^-$ | max: | 388,4 | (27) | 0,149 (11) |
| $\beta_{0,40}^-$ | avg: | 110,7 | (9) | |
| $\beta_{0,39}^-$ | max: | 399,5 | (27) | 1,93 (8) |
| $\beta_{0,39}^-$ | avg: | 114,3 | (9) | |
| $\beta_{0,38}^-$ | max: | 435,4 | (27) | 2,50 (16) |
| $\beta_{0,38}^-$ | avg: | 125,7 | (9) | |
| $\beta_{0,37}^-$ | max: | 440,0 | (27) | 0,20 (3) |
| $\beta_{0,37}^-$ | avg: | 127,2 | (9) | |
| $\beta_{0,36}^-$ | max: | 441,0 | (27) | 1,21 (4) |
| $\beta_{0,36}^-$ | avg: | 127,5 | (9) | |

| | | Energy keV | | Electrons per 100 disint. |
|------------------|------|---------------|------|------------------------------|
| $\beta_{0,35}^-$ | max: | 477,8 | (27) | 4,12 (20) |
| $\beta_{0,35}^-$ | avg: | 139,5 | (9) | |
| $\beta_{0,34}^-$ | max: | 480,7 | (27) | 0,82 (3) |
| $\beta_{0,34}^-$ | avg: | 140,4 | (9) | |
| $\beta_{0,33}^-$ | max: | 485,5 | (27) | 1,23 (6) |
| $\beta_{0,33}^-$ | avg: | 142,0 | (9) | |
| $\beta_{0,32}^-$ | max: | 506,0 | (27) | 0,071 (10) |
| $\beta_{0,32}^-$ | avg: | 148,7 | (9) | |
| $\beta_{0,31}^-$ | max: | 535,5 | (27) | 8,8 (23) |
| $\beta_{0,31}^-$ | avg: | 158,5 | (9) | |
| $\beta_{0,30}^-$ | max: | 584,6 | (27) | 0,030 (6) |
| $\beta_{0,30}^-$ | avg: | 175,0 | (9) | |
| $\beta_{0,27}^-$ | max: | 691,8 | (27) | 1,6 (5) |
| $\beta_{0,27}^-$ | avg: | 211,8 | (10) | |
| $\beta_{0,26}^-$ | max: | 707,7 | (27) | 0,060 (8) |
| $\beta_{0,26}^-$ | avg: | 217,3 | (10) | |
| $\beta_{0,25}^-$ | max: | 779,7 | (27) | 0,208 (18) |
| $\beta_{0,25}^-$ | avg: | 242,7 | (10) | |
| $\beta_{0,24}^-$ | max: | 826,4 | (27) | 1,46 (11) |
| $\beta_{0,24}^-$ | avg: | 259,4 | (10) | |
| $\beta_{0,23}^-$ | max: | 897,2 | (27) | 0,67 (8) |
| $\beta_{0,23}^-$ | avg: | 285,1 | (10) | |
| $\beta_{0,22}^-$ | max: | 948,4 | (27) | 0,166 (19) |
| $\beta_{0,22}^-$ | avg: | 303,9 | (10) | |
| $\beta_{0,20}^-$ | max: | 955,4 | (27) | 3,39 (13) |
| $\beta_{0,20}^-$ | avg: | 306,4 | (10) | |
| $\beta_{0,19}^-$ | max: | 970,3 | (27) | 6 (3) |
| $\beta_{0,19}^-$ | avg: | 311,9 | (10) | |
| $\beta_{0,18}^-$ | max: | 1000,8 | (27) | 6,67 (18) |
| $\beta_{0,18}^-$ | avg: | 323,2 | (10) | |
| $\beta_{0,16}^-$ | max: | 1063,9 | (27) | 0,099 (11) |
| $\beta_{0,16}^-$ | avg: | 346,7 | (11) | |
| $\beta_{0,15}^-$ | max: | 1101,3 | (27) | 3,0 (4) |
| $\beta_{0,15}^-$ | avg: | 360,8 | (11) | |
| $\beta_{0,14}^-$ | max: | 1107,4 | (27) | 0,39 (6) |
| $\beta_{0,14}^-$ | avg: | 363,1 | (11) | |
| $\beta_{0,13}^-$ | max: | 1144,3 | (27) | 0,238 (20) |
| $\beta_{0,13}^-$ | avg: | 377,1 | (11) | |
| $\beta_{0,12}^-$ | max: | 1154,8 | (27) | 31 (4) |
| $\beta_{0,12}^-$ | avg: | 381,1 | (11) | |
| $\beta_{0,11}^-$ | max: | 1155,4 | (27) | 0,18 (3) |
| $\beta_{0,11}^-$ | avg: | 381,4 | (11) | |

| | | Energy keV | | Electrons per 100 disint. |
|------------------|------|---------------|------|------------------------------|
| $\beta_{0,10}^-$ | max: | 1179,6 | (27) | 0,087 (16) |
| $\beta_{0,10}^-$ | avg: | 390,6 | (11) | |
| $\beta_{0,8}^-$ | max: | 1249,3 | (27) | 0,17 (10) |
| $\beta_{0,8}^-$ | avg: | 417,2 | (11) | |
| $\beta_{0,5}^-$ | max: | 1727,7 | (27) | 12,4 (5) |
| $\beta_{0,5}^-$ | avg: | 605,7 | (11) | |
| $\beta_{0,4}^-$ | max: | 1745,6 | (27) | 0,147 (21) |
| $\beta_{0,4}^-$ | avg: | 587,3 | (11) | |
| $\beta_{0,3}^-$ | max: | 1795,8 | (27) | 0,72 (23) |
| $\beta_{0,3}^-$ | avg: | 605,4 | (11) | |
| $\beta_{0,2}^-$ | max: | 1937,0 | (27) | 0,6 (5) |
| $\beta_{0,2}^-$ | avg: | 690,2 | (11) | |
| $\beta_{0,1}^-$ | max: | 2066,0 | (27) | 6 (4) |
| $\beta_{0,1}^-$ | avg: | 742,8 | (11) | |

5 Photon Emissions

5.1 X-Ray Emissions

| | | Energy keV | Photons per 100 disint. | |
|--------------------|------|-------------------|----------------------------|--------------|
| XL | (Th) | 11,1177 — 19,5043 | 37 (4) | |
| XK α_2 | (Th) | 89,954 | 2,5 (7) | } K α |
| XK α_1 | (Th) | 93,351 | 4,1 (11) | |
| XK β_3 | (Th) | 104,819 | } | K' β_1 |
| XK β_1 | (Th) | 105,604 | } | |
| XK β_5'' | (Th) | 106,239 | } | |
| XK β_2 | (Th) | 108,509 | } | |
| XK β_4 | (Th) | 108,955 | } | |
| XKO _{2,3} | (Th) | 109,442 | } | K' β_2 |

5.2 Gamma Emissions

| | Energy keV | Photons per 100 disint. |
|-----------------------|---------------|----------------------------|
| $\gamma_{28,27}$ (Th) | 18,415 (12) | 0,019 (4) |
| $\gamma_{38,35}$ (Th) | 42,46 (5) | 0,009 (3) |
| $\gamma_{31,29}$ (Th) | 56,88 (5) | 0,020 (5) |
| $\gamma_{1,0}$ (Th) | 57,752 (13) | 0,470 (17) |
| $\gamma_{20,17}$ (Th) | 77,34 (3) | 0,027 (6) |
| $\gamma_{29,27}$ (Th) | 99,505 (12) | 1,26 (4) |
| $\gamma_{18,15}$ (Th) | 100,41 (3) | 0,114 (6) |
| $\gamma_{35,29}$ (Th) | 114,56 (7) | 0,0102 (22) |
| $\gamma_{2,1}$ (Th) | 129,065 (3) | 2,50 (7) |
| $\gamma_{23,17}$ (Th) | 135,507 (22) | 0,024 (6) |
| $\gamma_{31,28}$ (Th) | 137,936 (22) | 0,028 (4) |
| $\gamma_{6,4}$ (Th) | 140,999 (20) | 0,045 (9) |
| $\gamma_{20,15}$ (Th) | 145,842 (20) | 0,169 (6) |
| $\gamma_{18,12}$ (Th) | 153,967 (11) | 0,754 (23) |
| $\gamma_{25,22}$ (Th) | 168,53 (12) | 0,0111 (27) |
| $\gamma_{49,43}$ (Th) | 168,53 (12) | 0,0025 (7) |
| $\gamma_{19,13}$ (Th) | 173,96 (3) | 0,036 (5) |
| $\gamma_{19,12}$ (Th) | 184,547 (19) | 0,054 (19) |
| $\gamma_{4,2}$ (Th) | 191,351 (17) | 0,133 (8) |
| $\gamma_{20,12}$ (Th) | 199,402 (15) | 0,299 (23) |
| $\gamma_{24,15}$ (Th) | 204,029 (11) | 0,114 (8) |
| $\gamma_{5,2}$ (Th) | 209,248 (7) | 3,97 (13) |
| $\gamma_{19,9}$ (Th) | 214,89 (10) | 0,031 (5) |
| $\gamma_{28,23}$ (Th) | 223,793 (21) | 0,058 (6) |
| $\gamma_{22,10}$ (Th) | 231,42 (10) | 0,026 (4) |

| | Energy keV | Photons per 100 disint. |
|-----------------------------|---------------|----------------------------|
| $\gamma_{27,21}(\text{Th})$ | 257,482 (21) | 0,0286 (19) |
| $\gamma_{27,20}(\text{Th})$ | 263,58 (10) | 0,043 (3) |
| $\gamma_{3,1}(\text{Th})$ | 270,245 (7) | 3,55 (10) |
| $\gamma_{27,19}(\text{Th})$ | 278,80 (15) | 0,031 (5) |
| $\gamma_{19,8}(\text{Th})$ | 278,80 (15) | 0,204 (28) |
| $\gamma_{28,20}(\text{Th})$ | 282,02 (4) | 0,09 (3) |
| $\gamma_{19,7}(\text{Th})$ | 321,646 (8) | 0,232 (14) |
| $\gamma_{42,27}(\text{Th})$ | 326,04 (20) | 0,035 (6) |
| $\gamma_{3,0}(\text{Th})$ | 328,004 (7) | 3,04 (11) |
| $\gamma_{6,2}(\text{Th})$ | 332,371 (6) | 0,37 (6) |
| $\gamma_{5,1}(\text{Th})$ | 338,320 (5) | 11,4 (4) |
| $\gamma_{27,17}(\text{Th})$ | 340,969 (21) | 0,405 (20) |
| $\gamma_{51,31}(\text{Th})$ | 356,7 (3) | 0,0178 (21) |
| $\gamma_{55,33}(\text{Th})$ | 372,59 (3) | 0,0070 (17) |
| $\gamma_{29,19}(\text{Th})$ | 377,99 (10) | 0,026 (3) |
| $\gamma_{57,33}(\text{Th})$ | 384,47 (9) | 0,0070 (17) |
| $\gamma_{49,30}(\text{Th})$ | 389,32 (13) | 0,0108 (17) |
| $\gamma_{50,30}(\text{Th})$ | 397,95 (10) | 0,029 (3) |
| $\gamma_{41,25}(\text{Th})$ | 399,83 (14) | 0,031 (4) |
| $\gamma_{27,15}(\text{Th})$ | 409,460 (13) | 2,02 (6) |
| $\gamma_{30,18}(\text{Th})$ | 415,96 (14) | 0,0138 (23) |
| $\gamma_{35,23}(\text{Th})$ | 419,38 (7) | 0,022 (3) |
| $\gamma_{29,17}(\text{Th})$ | 440,450 (24) | 0,128 (10) |
| $\gamma_{11,6}(\text{Th})$ | 449,11 (6) | 0,050 (6) |
| $\gamma_{27,13}(\text{Th})$ | 452,50 (6) | 0,0199 (19) |
| $\gamma_{37,23}(\text{Th})$ | 457,18 (15) | 0,016 (3) |
| $\gamma_{27,12}(\text{Th})$ | 463,002 (6) | 4,45 (24) |
| $\gamma_{33,20}(\text{Th})$ | 470,21 (20) | 0,014 (3) |
| $\gamma_{26,10}(\text{Th})$ | 471,77 (15) | 0,034 (4) |
| $\gamma_{34,20}(\text{Th})$ | 474,79 (10) | 0,023 (4) |
| $\gamma_{8,5}(\text{Th})$ | 478,40 (5) | 0,224 (19) |
| $\gamma_{48,26}(\text{Th})$ | 490,33 (15) | 0,0116 (25) |
| $\gamma_{35,19}(\text{Th})$ | 492,29 (8) | 0,025 (3) |
| $\gamma_{39,23}(\text{Th})$ | 497,64 (10) | 0,0062 (19) |
| $\gamma_{7,3}(\text{Th})$ | 503,819 (23) | 0,171 (19) |
| $\gamma_{29,15}(\text{Th})$ | 508,955 (13) | 0,51 (4) |
| $\gamma_{33,18}(\text{Th})$ | 515,12 (7) | 0,051 (6) |
| $\gamma_{34,18}(\text{Th})$ | 520,16 (3) | 0,070 (7) |
| $\gamma_{35,18}(\text{Th})$ | 523,129 (22) | 0,129 (10) |
| $\gamma_{16,6}(\text{Th})$ | 540,67 (5) | 0,027 (3) |
| $\gamma_{8,3}(\text{Th})$ | 546,445 (21) | 0,199 (16) |
| $\gamma_{39,22}(\text{Th})$ | 548,73 (11) | 0,024 (4) |
| $\gamma_{35,17}(\text{Th})$ | 555,07 (16) | 0,048 (6) |
| $\gamma_{29,12}(\text{Th})$ | 562,496 (7) | 0,89 (4) |
| $\gamma_{39,19}(\text{Th})$ | 570,88 (4) | 0,19 (5) |
| $\gamma_{11,5}(\text{Th})$ | 572,10 (5) | 0,156 (18) |
| $\gamma_{13,5}(\text{Th})$ | 583,391 (10) | 0,120 (11) |

| | Energy keV | Photons per 100 disint. |
|-----------------------------|---------------|----------------------------|
| $\gamma_{9,3}(\text{Th})$ | 610,65 (10) | 0,024 (5) |
| $\gamma_{10,3}(\text{Th})$ | 616,21 (3) | 0,084 (7) |
| $\gamma_{14,5}(\text{Th})$ | 620,32 (7) | 0,084 (7) |
| $\gamma_{35,15}(\text{Th})$ | 623,48 (22) | 0,012 (3) |
| $\gamma_{34,14}(\text{Th})$ | 626,80 (22) | 0,015 (3) |
| $\gamma_{35,14}(\text{Th})$ | 629,41 (5) | 0,047 (5) |
| $\gamma_{11,3}(\text{Th})$ | 640,32 (4) | 0,057 (6) |
| $\gamma_{32,12}(\text{Th})$ | 649,02 (12) | 0,0086 (9) |
| $\gamma_{20,6}(\text{Th})$ | 649,02 (12) | 0,0332 (36) |
| $\gamma_{13,3}(\text{Th})$ | 651,53 (3) | 0,094 (10) |
| $\gamma_{36,15}(\text{Th})$ | 660,1 (3) | 0,0054 (3) |
| $\gamma_{16,5}(\text{Th})$ | 663,88 (8) | 0,029 (6) |
| $\gamma_{35,13}(\text{Th})$ | 666,45 (5) | 0,058 (6) |
| $\gamma_{46,23}(\text{Th})$ | 666,45 (5) | 0,0068 (7) |
| $\gamma_{38,14}(\text{Th})$ | 671,95 (8) | 0,027 (8) |
| $\gamma_{34,12}(\text{Th})$ | 674,63 (4) | 0,105 (10) |
| $\gamma_{35,12}(\text{Th})$ | 677,08 (10) | 0,065 (6) |
| $\gamma_{14,3}(\text{Th})$ | 688,12 (4) | 0,070 (7) |
| $\gamma_{34,10}(\text{Th})$ | 698,99 (10) | 0,038 (6) |
| $\gamma_{39,15}(\text{Th})$ | 701,742 (15) | 0,181 (15) |
| $\gamma_{23,6}(\text{Th})$ | 707,42 (5) | 0,162 (18) |
| $\gamma_{51,23}(\text{Th})$ | 718,30 (3) | 0,019 (4) |
| $\gamma_{18,5}(\text{Th})$ | 726,88 (10) | 0,68 (8) |
| $\gamma_{43,15}(\text{Th})$ | 737,74 (5) | 0,039 (5) |
| $\gamma_{39,12}(\text{Th})$ | 755,313 (9) | 1,03 (4) |
| $\gamma_{20,5}(\text{Th})$ | 772,291 (7) | 1,52 (6) |
| $\gamma_{7,1}(\text{Th})$ | 774,07 (10) | 0,062 (4) |
| $\gamma_{51,20}(\text{Th})$ | 776,51 (3) | 0,020 (6) |
| $\gamma_{12,2}(\text{Th})$ | 782,140 (6) | 0,50 (4) |
| $\gamma_{51,19}(\text{Th})$ | 791,43 (9) | 0,014 (4) |
| $\gamma_{43,12}(\text{Th})$ | 791,43 (9) | 0,010 (3) |
| $\gamma_{13,2}(\text{Th})$ | 792,69 (10) | 0,081 (5) |
| $\gamma_{18,3}(\text{Th})$ | 794,942 (14) | 4,31 (14) |
| $\gamma_{38,8}(\text{Th})$ | 813,88 (10) | 0,0073 (17) |
| $\gamma_{8,1}(\text{Th})$ | 816,82 (10) | 0,031 (4) |
| $\gamma_{25,6}(\text{Th})$ | 824,931 (25) | 0,053 (6) |
| $\gamma_{23,5}(\text{Th})$ | 830,481 (8) | 0,61 (6) |
| $\gamma_{15,2}(\text{Th})$ | 835,704 (8) | 1,70 (7) |
| $\gamma_{20,3}(\text{Th})$ | 840,372 (9) | 0,97 (4) |
| $\gamma_{51,17}(\text{Th})$ | 853,96 (8) | 0,0124 (20) |
| $\gamma_{46,15}(\text{Th})$ | 870,47 (7) | 0,046 (5) |
| $\gamma_{16,2}(\text{Th})$ | 873,10 (15) | 0,032 (7) |
| $\gamma_{8,0}(\text{Th})$ | 874,45 (8) | 0,050 (11) |
| $\gamma_{47,15}(\text{Th})$ | 877,38 (7) | 0,014 (3) |
| $\gamma_{9,1}(\text{Th})$ | 880,76 (10) | 0,0065 (19) |
| $\gamma_{55,18}(\text{Th})$ | 887,26 (10) | 0,029 (3) |
| $\gamma_{24,5}(\text{Th})$ | 901,38 (3) | 0,017 (4) |

| | Energy keV | Photons per 100 disint. |
|-----------------------------|---------------|----------------------------|
| $\gamma_{17,2}(\text{Th})$ | 904,20 (5) | 0,78 (4) |
| $\gamma_{12,1}(\text{Th})$ | 911,196 (6) | 26,2 (8) |
| $\gamma_{55,17}(\text{Th})$ | 919,03 (12) | 0,028 (3) |
| $\gamma_{13,1}(\text{Th})$ | 921,87 (12) | 0,0154 (23) |
| $\gamma_{47,12}(\text{Th})$ | 930,99 (7) | 0,004 (1) |
| $\gamma_{28,6}(\text{Th})$ | 930,99 (7) | 0,0025 (23) |
| $\gamma_{58,17}(\text{Th})$ | 939,89 (15) | 0,009 (3) |
| $\gamma_{10,0}(\text{Th})$ | 944,19 (3) | 0,10 (1) |
| $\gamma_{25,5}(\text{Th})$ | 947,976 (24) | 0,111 (10) |
| $\gamma_{14,1}(\text{Th})$ | 958,59 (4) | 0,29 (5) |
| $\gamma_{15,1}(\text{Th})$ | 964,786 (8) | 4,99 (17) |
| $\gamma_{12,0}(\text{Th})$ | 968,960 (9) | 15,9 (5) |
| $\gamma_{51,12}(\text{Th})$ | 975,98 (5) | 0,052 (6) |
| $\gamma_{13,0}(\text{Th})$ | 979,49 (10) | 0,028 (3) |
| $\gamma_{21,2}(\text{Th})$ | 987,87 (10) | 0,14 (6) |
| $\gamma_{22,2}(\text{Th})$ | 988,65 (20) | 0,081 (14) |
| $\gamma_{51,10}(\text{Th})$ | 1000,68 (10) | 0,0054 (3) |
| $\gamma_{58,14}(\text{Th})$ | 1013,55 (13) | 0,0097 (16) |
| $\gamma_{14,0}(\text{Th})$ | 1016,44 (10) | 0,019 (3) |
| $\gamma_{54,12}(\text{Th})$ | 1017,94 (20) | 0,03 (3) |
| $\gamma_{26,5}(\text{Th})$ | 1019,88 (10) | 0,022 (5) |
| $\gamma_{17,1}(\text{Th})$ | 1033,244 (23) | 0,204 (12) |
| $\gamma_{23,2}(\text{Th})$ | 1039,83 (7) | 0,056 (18) |
| $\gamma_{55,12}(\text{Th})$ | 1040,94 (15) | 0,047 (10) |
| $\gamma_{57,12}(\text{Th})$ | 1053,11 (20) | 0,014 (4) |
| $\gamma_{28,5}(\text{Th})$ | 1054,13 (20) | 0,019 (6) |
| $\gamma_{50,8}(\text{Th})$ | 1062,57 (15) | 0,011 (4) |
| $\gamma_{18,1}(\text{Th})$ | 1065,168 (15) | 0,135 (8) |
| $\gamma_{48,7}(\text{Th})$ | 1074,73 (15) | 0,011 (4) |
| $\gamma_{26,3}(\text{Th})$ | 1088,20 (15) | 0,0062 (14) |
| $\gamma_{19,1}(\text{Th})$ | 1095,671 (23) | 0,126 (10) |
| $\gamma_{27,3}(\text{Th})$ | 1103,43 (10) | 0,0102 (11) |
| $\gamma_{20,1}(\text{Th})$ | 1110,604 (9) | 0,284 (22) |
| $\gamma_{24,2}(\text{Th})$ | 1110,604 (9) | 0,0272 (21) |
| $\gamma_{22,1}(\text{Th})$ | 1117,65 (10) | 0,061 (7) |
| $\gamma_{29,5}(\text{Th})$ | 1135,26 (15) | 0,0102 (17) |
| $\gamma_{30,5}(\text{Th})$ | 1142,87 (15) | 0,0108 (22) |
| $\gamma_{57,8}(\text{Th})$ | 1148,17 (14) | 0,0062 (14) |
| $\gamma_{19,0}(\text{Th})$ | 1153,27 (4) | 0,148 (13) |
| $\gamma_{25,2}(\text{Th})$ | 1157,16 (15) | 0,0073 (14) |
| $\gamma_{37,6}(\text{Th})$ | 1164,55 (7) | 0,067 (7) |
| $\gamma_{22,0}(\text{Th})$ | 1175,33 (10) | 0,025 (4) |
| $\gamma_{57,7}(\text{Th})$ | 1190,83 (20) | 0,0065 (17) |
| $\gamma_{40,6}(\text{Th})$ | 1217,03 (10) | 0,022 (4) |
| $\gamma_{26,2}(\text{Th})$ | 1229,42 (15) | 0,0078 (25) |
| $\gamma_{27,2}(\text{Th})$ | 1245,15 (6) | 0,110 (8) |
| $\gamma_{34,5}(\text{Th})$ | 1247,10 (5) | 0,524 (24) |

| | Energy keV | Photons per 100 disint. |
|----------------------------|---------------|----------------------------|
| $\gamma_{35,5}(\text{Th})$ | 1250,06 (5) | 0,065 (6) |
| $\gamma_{44,6}(\text{Th})$ | 1276,72 (10) | 0,015 (3) |
| $\gamma_{25,1}(\text{Th})$ | 1286,29 (20) | 0,052 (11) |
| $\gamma_{37,5}(\text{Th})$ | 1287,77 (8) | 0,109 (25) |
| $\gamma_{33,3}(\text{Th})$ | 1309,76 (20) | 0,020 (7) |
| $\gamma_{34,3}(\text{Th})$ | 1315,33 (10) | 0,015 (3) |
| $\gamma_{29,2}(\text{Th})$ | 1344,62 (15) | 0,0094 (20) |
| $\gamma_{41,5}(\text{Th})$ | 1347,50 (15) | 0,016 (4) |
| $\gamma_{40,4}(\text{Th})$ | 1357,81 (15) | 0,021 (5) |
| $\gamma_{41,4}(\text{Th})$ | 1365,71 (12) | 0,014 (3) |
| $\gamma_{27,1}(\text{Th})$ | 1374,24 (7) | 0,0196 (14) |
| $\gamma_{45,5}(\text{Th})$ | 1401,52 (10) | 0,013 (3) |
| $\gamma_{41,3}(\text{Th})$ | 1415,55 (14) | 0,022 (5) |
| $\gamma_{32,2}(\text{Th})$ | 1430,99 (10) | 0,037 (8) |
| $\gamma_{28,0}(\text{Th})$ | 1451,43 (15) | 0,0111 (22) |
| $\gamma_{35,2}(\text{Th})$ | 1459,131 (22) | 0,87 (5) |
| $\gamma_{45,3}(\text{Th})$ | 1469,74 (15) | 0,021 (5) |
| $\gamma_{36,2}(\text{Th})$ | 1495,904 (16) | 0,92 (3) |
| $\gamma_{38,2}(\text{Th})$ | 1501,59 (5) | 0,513 (17) |
| $\gamma_{39,2}(\text{Th})$ | 1537,89 (10) | 0,049 (6) |
| $\gamma_{40,2}(\text{Th})$ | 1548,65 (6) | 0,040 (5) |
| $\gamma_{41,2}(\text{Th})$ | 1557,13 (7) | 0,173 (9) |
| $\gamma_{32,1}(\text{Th})$ | 1560,02 (7) | 0,021 (5) |
| $\gamma_{42,2}(\text{Th})$ | 1571,55 (20) | 0,0059 (17) |
| $\gamma_{43,2}(\text{Th})$ | 1573,389 (24) | 0,034 (4) |
| $\gamma_{33,1}(\text{Th})$ | 1580,531 (25) | 0,62 (4) |
| $\gamma_{35,1}(\text{Th})$ | 1588,200 (25) | 3,06 (12) |
| $\gamma_{54,4}(\text{Th})$ | 1609,44 (15) | 0,0081 (17) |
| $\gamma_{36,1}(\text{Th})$ | 1625,09 (4) | 0,270 (23) |
| $\gamma_{38,1}(\text{Th})$ | 1630,618 (20) | 1,52 (6) |
| $\gamma_{33,0}(\text{Th})$ | 1638,272 (23) | 0,46 (3) |
| $\gamma_{39,1}(\text{Th})$ | 1666,514 (13) | 0,173 (9) |
| $\gamma_{40,1}(\text{Th})$ | 1677,66 (6) | 0,057 (6) |
| $\gamma_{41,1}(\text{Th})$ | 1686,22 (11) | 0,094 (7) |
| $\gamma_{42,1}(\text{Th})$ | 1700,62 (20) | 0,0105 (25) |
| $\gamma_{43,1}(\text{Th})$ | 1702,40 (8) | 0,055 (7) |
| $\gamma_{46,2}(\text{Th})$ | 1706,17 (7) | 0,0089 (12) |
| $\gamma_{47,2}(\text{Th})$ | 1713,49 (20) | 0,0057 (11) |
| $\gamma_{39,0}(\text{Th})$ | 1724,19 (5) | 0,030 (4) |
| $\gamma_{44,1}(\text{Th})$ | 1738,46 (5) | 0,018 (4) |
| $\gamma_{45,1}(\text{Th})$ | 1740,5 (3) | 0,011 (4) |
| $\gamma_{49,2}(\text{Th})$ | 1742,1 (3) | 0,0084 (25) |
| $\gamma_{50,2}(\text{Th})$ | 1750,58 (20) | 0,0084 (9) |
| $\gamma_{51,2}(\text{Th})$ | 1758,11 (5) | 0,036 (4) |
| $\gamma_{52,2}(\text{Th})$ | 1772,2 (3) | 0,0019 (5) |
| $\gamma_{60,3}(\text{Th})$ | 1795,13 (6) | 0,0022 (8) |
| $\gamma_{45,0}(\text{Th})$ | 1797,5 (5) | 0,0022 (8) |

| | Energy keV | Photons per 100 disint. |
|----------------------------|---------------|----------------------------|
| $\gamma_{54,2}(\text{Th})$ | 1800,9 (2) | 0,0046 (8) |
| $\gamma_{55,2}(\text{Th})$ | 1823,22 (10) | 0,046 (5) |
| $\gamma_{56,2}(\text{Th})$ | 1826,8 (3) | 0,0022 (8) |
| $\gamma_{46,1}(\text{Th})$ | 1835,29 (10) | 0,038 (4) |
| $\gamma_{47,1}(\text{Th})$ | 1842,15 (8) | 0,037 (6) |
| $\gamma_{59,2}(\text{Th})$ | 1850,17 (20) | 0,0046 (8) |
| $\gamma_{49,1}(\text{Th})$ | 1870,82 (9) | 0,0257 (24) |
| $\gamma_{50,1}(\text{Th})$ | 1879,6 (3) | 0,0013 (5) |
| $\gamma_{51,1}(\text{Th})$ | 1887,13 (5) | 0,094 (7) |
| $\gamma_{47,0}(\text{Th})$ | 1900,16 (20) | 0,0030 (6) |
| $\gamma_{53,1}(\text{Th})$ | 1907,14 (11) | 0,0124 (13) |
| $\gamma_{54,1}(\text{Th})$ | 1929,78 (20) | 0,0208 (14) |
| $\gamma_{60,2}(\text{Th})$ | 1936,3 (3) | 0,0022 (6) |
| $\gamma_{55,1}(\text{Th})$ | 1952,37 (10) | 0,062 (5) |
| $\gamma_{56,1}(\text{Th})$ | 1955,9 (5) | 0,0008 (3) |
| $\gamma_{52,0}(\text{Th})$ | 1958,4 (3) | 0,0016 (5) |
| $\gamma_{57,1}(\text{Th})$ | 1965,22 (12) | 0,0223 (22) |
| $\gamma_{58,1}(\text{Th})$ | 1972,0 (3) | 0,0038 (8) |
| $\gamma_{59,1}(\text{Th})$ | 1979,3 (3) | 0,0019 (5) |
| $\gamma_{58,0}(\text{Th})$ | 2029,4 (5) | 0,0019 (5) |

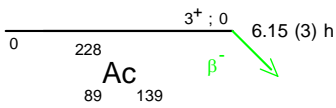
6 Main Production Modes

Th – 232 decay chain

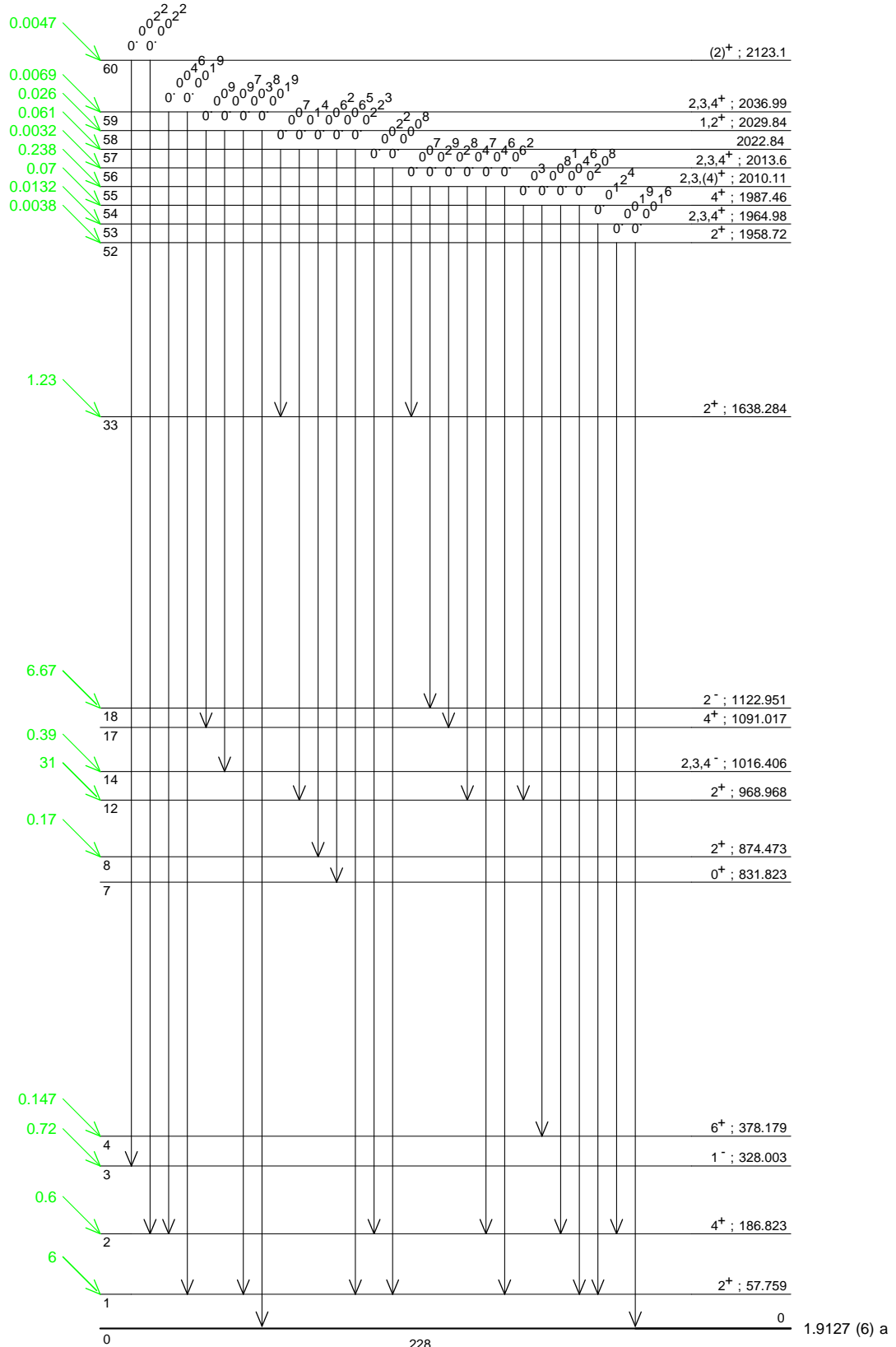
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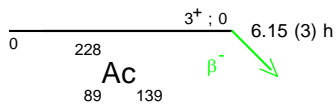
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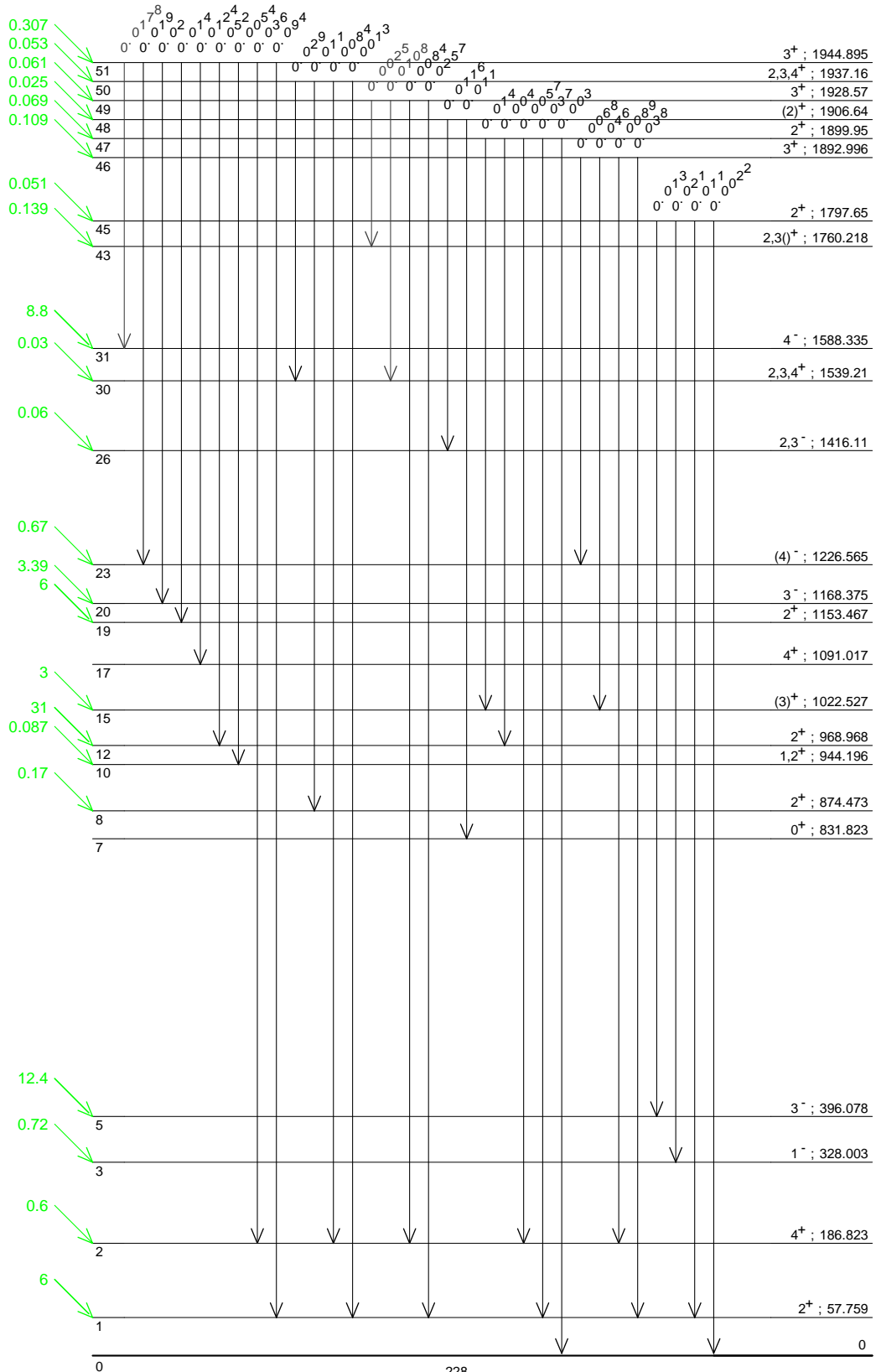
γ Emission intensities per 100 disintegrations



²²⁸Th
 90 138
 Q⁻ = 2123.8 keV
 % β⁻ = 100

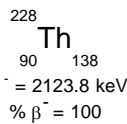


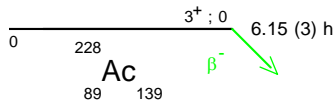
γ Emission intensities per 100 disintegrations



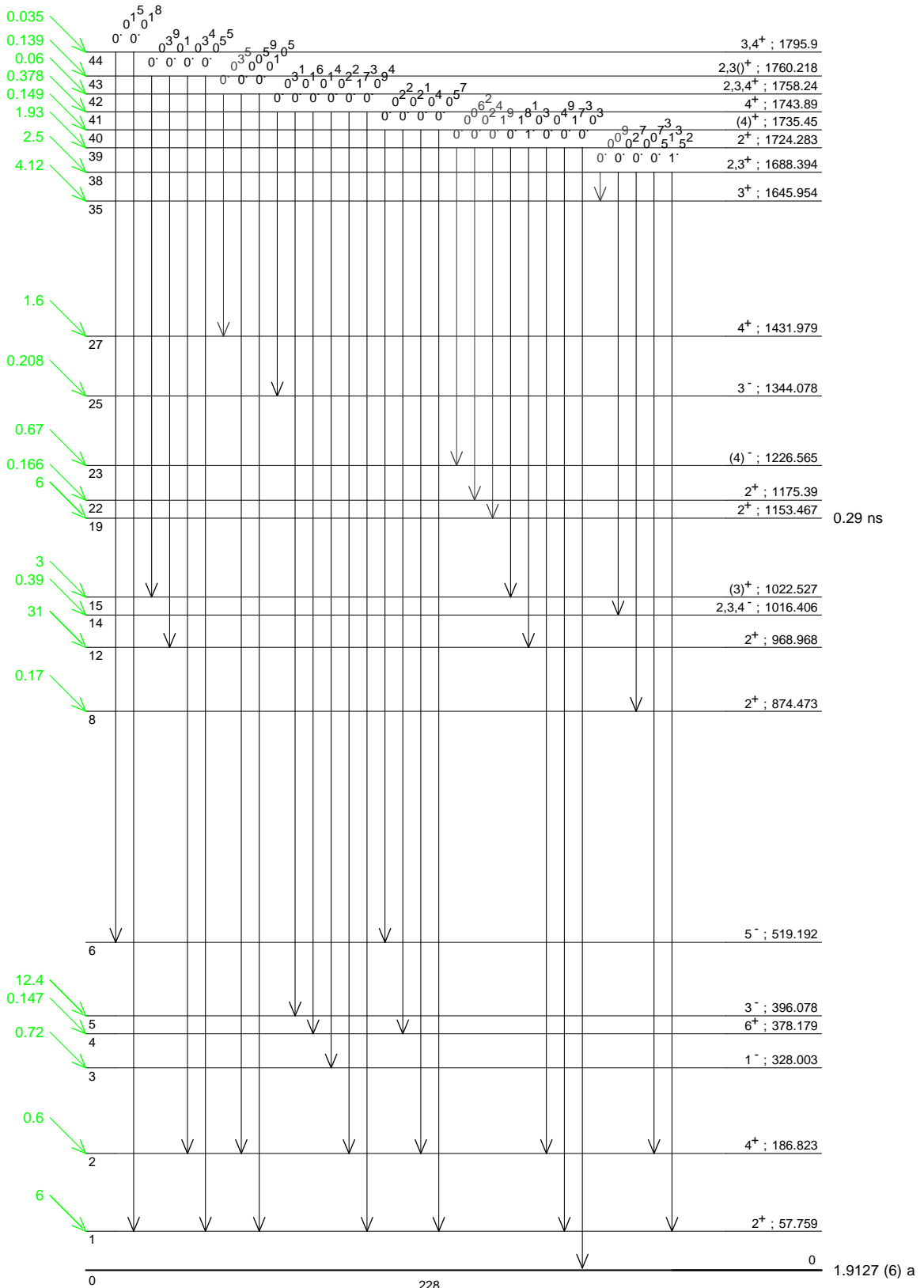
0.29 ns

1.9127 (6) a

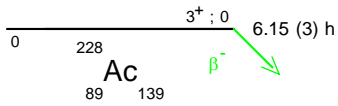




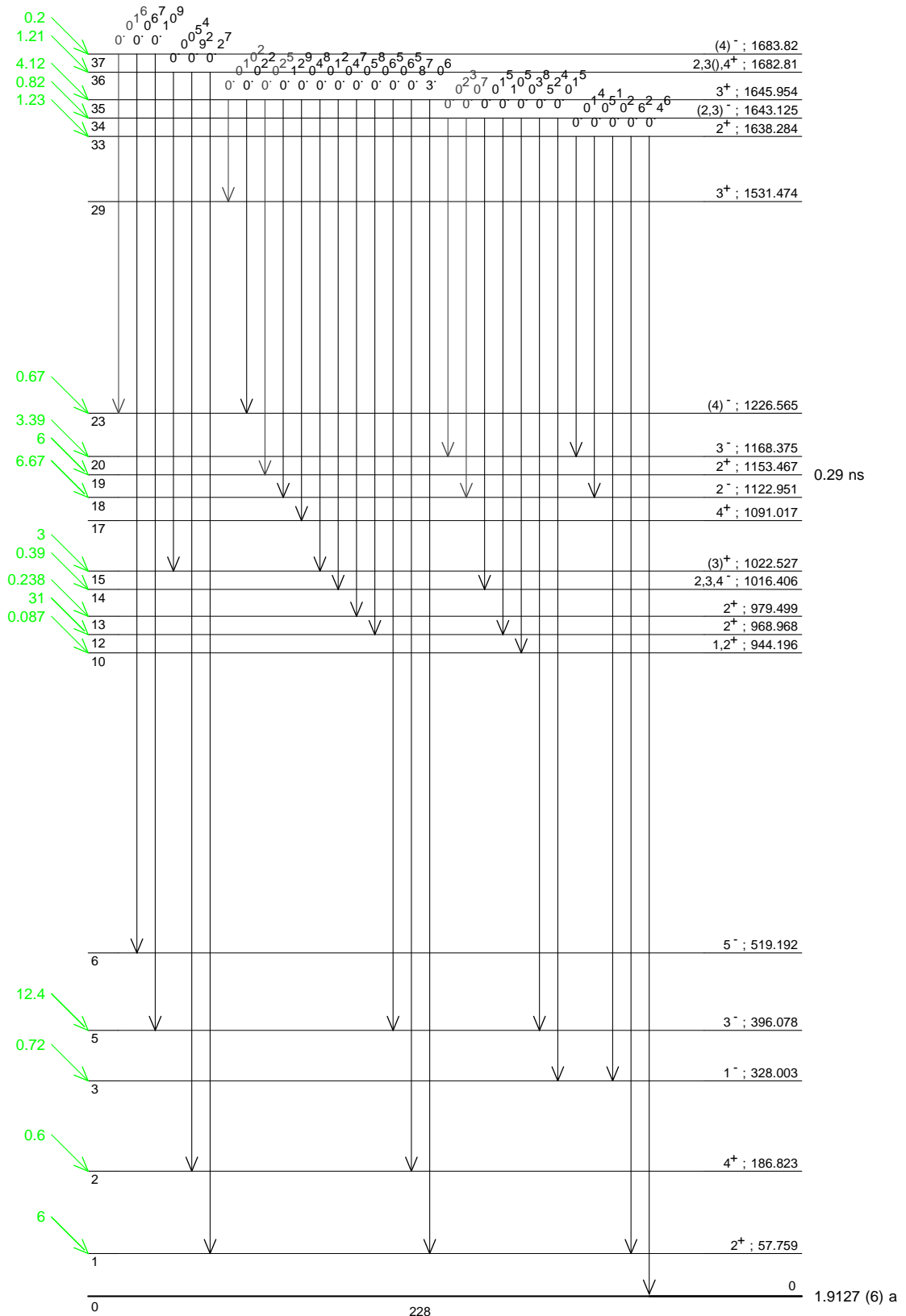
γ Emission intensities per 100 disintegrations



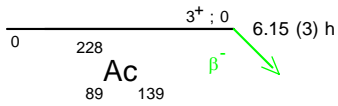
²²⁸Th
 90 138
 Q⁻ = 2123.8 keV
 % β^- = 100



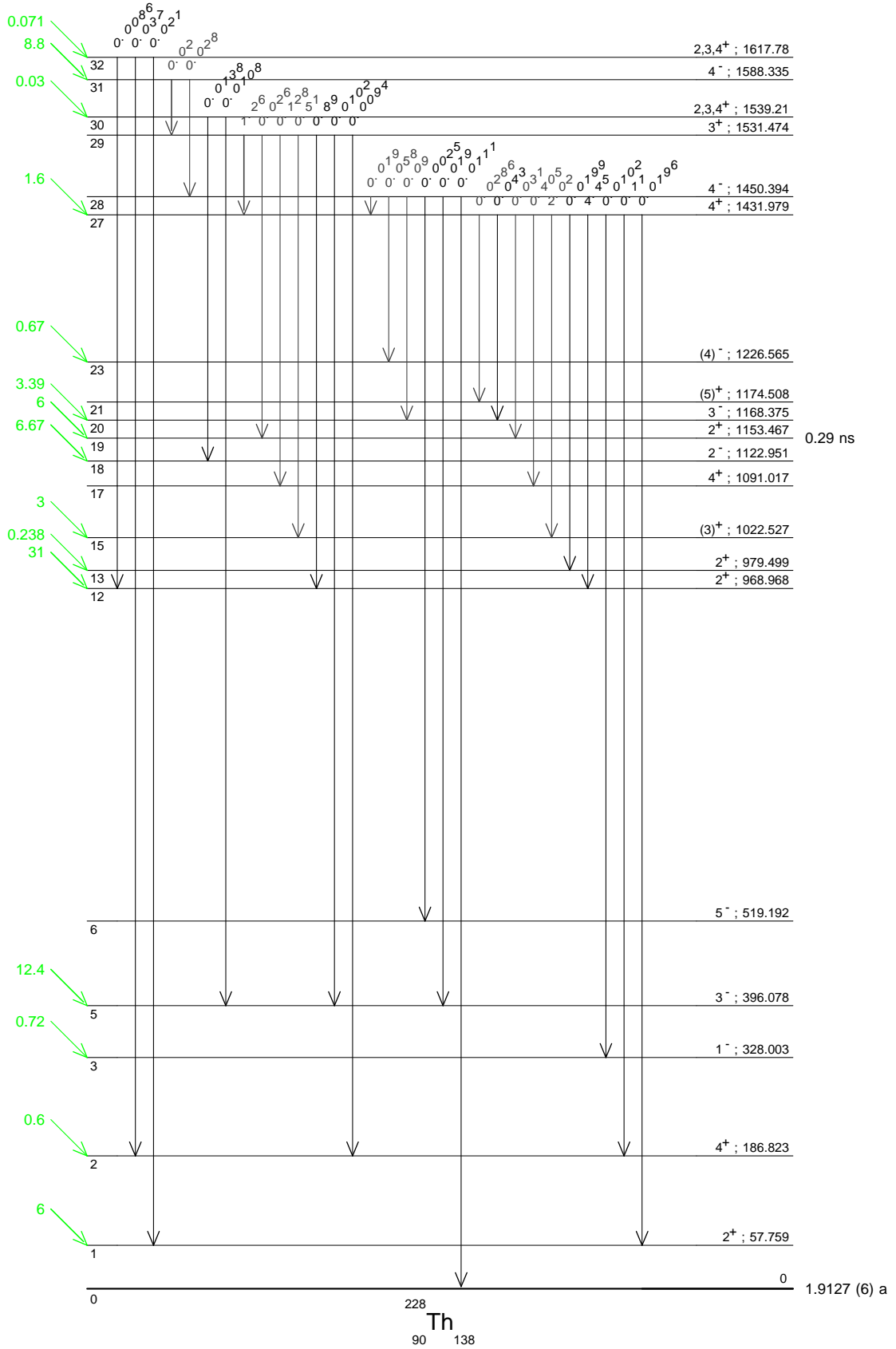
γ Emission intensities per 100 disintegrations

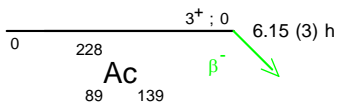


$^{228}_{90}\text{Th}$
 $Q^- = 2123.8 \text{ keV}$
 $\% \beta^- = 100$
 Scheme page : 4/8

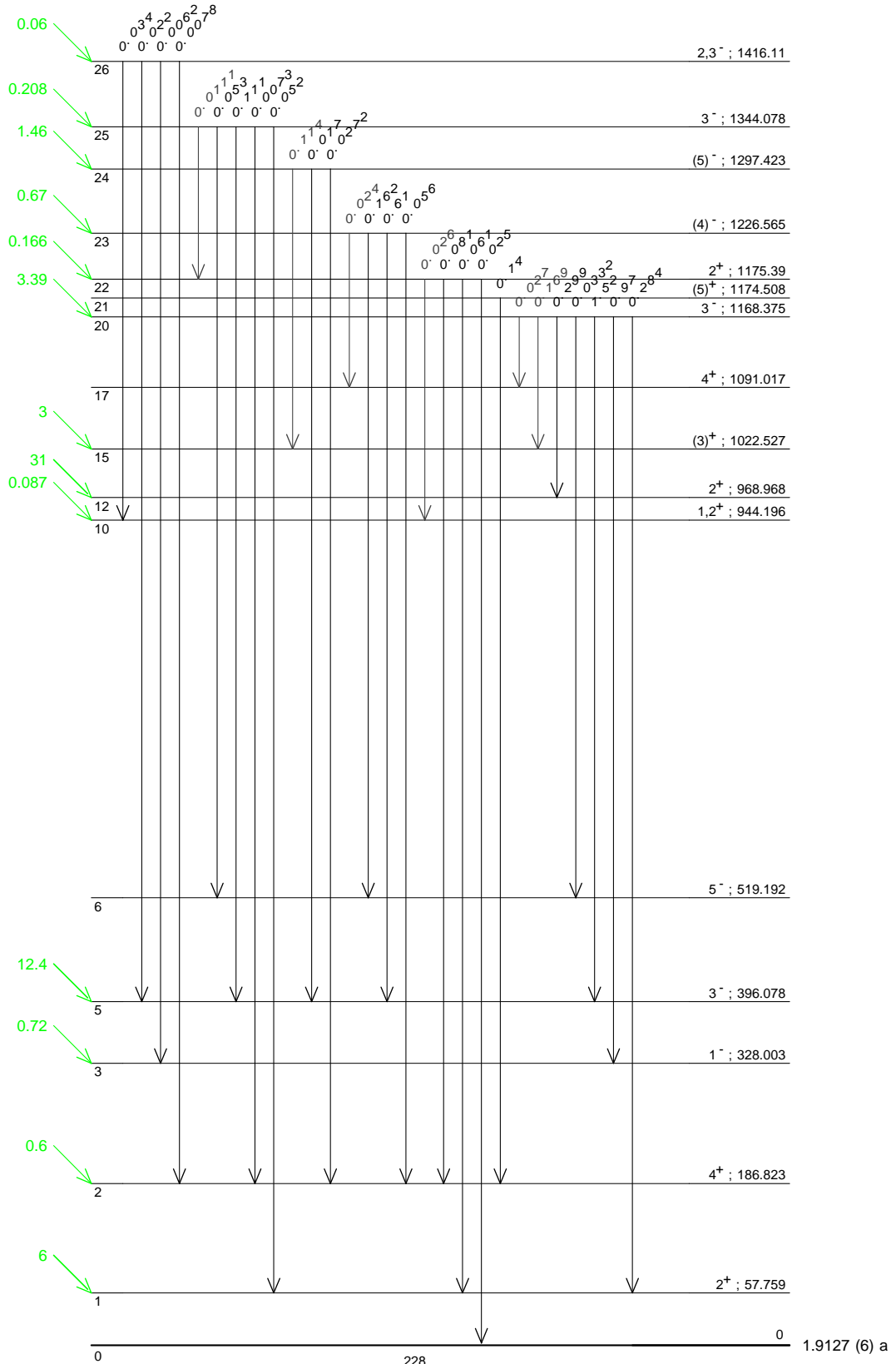


γ Emission intensities per 100 disintegrations

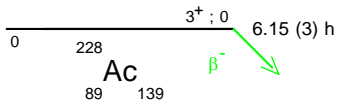




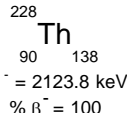
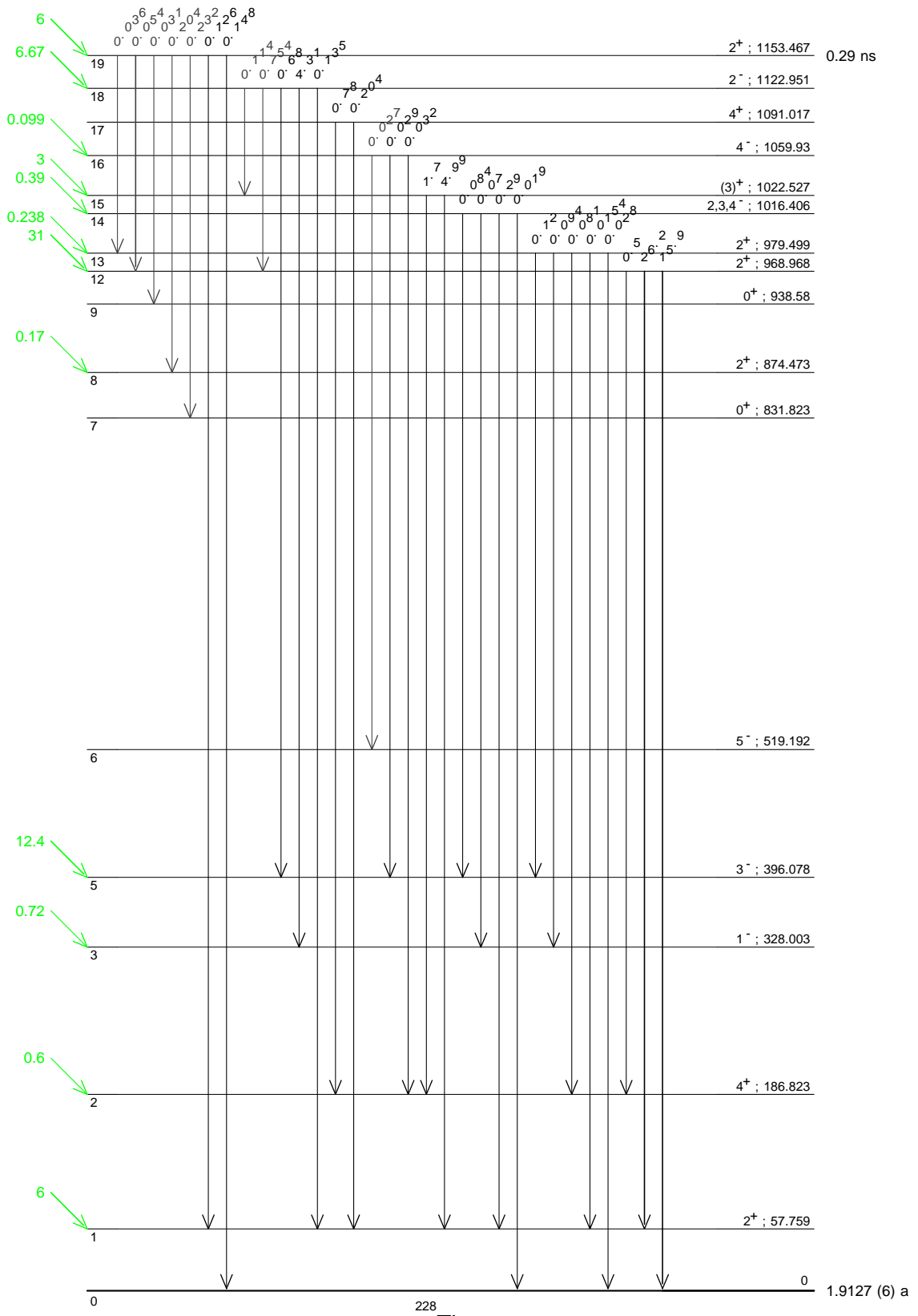
γ Emission intensities per 100 disintegrations

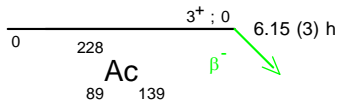


Q⁻ = 2123.8 keV
 % β^- = 100



γ Emission intensities per 100 disintegrations





γ Emission intensities per 100 disintegrations

